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THESIS

AN ORGANIZATIONAL ASSESSMENT OF THE UNITED STATES MILITARY'S ABILITY TO CONTROL THE ELECTROMAGNETIC SPECTRUM IN THE 21ST CENTURY

by

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December 2007

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13. ABSTRACT (maximum 200 words)

The United States (U.S.) has the best-trained and equipped military in the world; however; these factors do not necessarily equate to success in operations. Information is a vital component of warfare that facilitates success. Electronic warfare (EW) organizations in the U.S. military are tasked to control battlefield information flow throughout the range of military operations. Historically, the U.S. has effectively accomplished this mission; however, recent events reveal symptoms of a decline in America's ability to exploit, attack, and protect information systems. This thesis executed a contingency theory based organizational analysis of command level EW organizations responsible for EW plans and management within the Department of Defense. The collective assessment using the combined open systems model and ORGCON (Burton *et al.*, 1998) expert system revealed the organization has not adequately adjusted to the dynamic environment of the twenty first century. Implementation of recommended changes to the EW strategic task, leadership rank structure, education system, and division of EW may assist the U.S. military to maintain its information advantage in future operations.

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AN ORGANIZATIONAL ASSESSMENT OF THE UNITED STATES MILITARY'S ABILITY TO CONTROL THE ELECTROMAGNETIC SPECTRUM IN THE 21ST CENTURY

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ABSTRACT

The United States (U.S.) has the best-trained and equipped military in the world; however; these factors do not necessarily equate to success in operations. Information is a vital component of warfare that facilitates success. Electronic warfare (EW) organizations in the U.S. military are tasked to control battlefield information flow throughout the range of military operations. Historically, the U.S. has effectively accomplished this mission; however, recent events reveal symptoms of a decline in America's ability to exploit, attack, and protect information systems. This thesis executed a contingency theory based organizational analysis of command level EW organizations responsible for EW plans and management within the Department of Defense. The collective assessment using the combined open systems model and ORGCON (Burton *et al.*, 1998) expert system revealed the organization has not adequately adjusted to the dynamic environment of the twenty first century. Implementation of recommended changes to the EW strategic task, leadership rank structure, education system, and division of EW may assist the U.S. military to maintain its information advantage in future operations.

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LIST OF ACRONYMS

AF	United States Air Force
AFSC	Air Force Specialty Code
AOC	Association of Old Crows (Professional EW organization)
C2	Command and Control
CC	Commander
CJCS	Chairmen, Joint Chiefs of Staff
CNA	Computer Network Attack
CND	Computer Network Defense
CNE	Computer Network Exploitation
CNO	Computer Network Operations (this includes the operations of Computer Network Attack, Exploitation and Defense)
COA	Course of Action
COCOM	Combatant Commander
COTS	Commercial off the shelf
C-RCIED	Counter Radio Controlled Improvised Explosive Devices
CREW	**C**ounter **R**adio Controlled Improvised Explosive Devices **E**lectronic **W**arfare
CSO	Combat Systems Officer
DoD	Department of Defense
DOPMA	Defense Officer Personnel Management Act
EA	Electronic Attack
ECMO	Electronic Counter Measures Officer
EFP	Explosively Formed Penetrator
EM	Electromagnetic Spectrum
EME	Electromagnetic Spectrum Environment
EP	Electronic Protect
ES	Electronic Warfare Support
EW	Electronic Warfare
EWO	Electronic Warfare Officer
EWCC	Electronic Warfare Coordination Cell

EWWG	Electronic Warfare Working Group (U.S. Congressional Committee)
FMO	Frequency Management Office
FTS	Flying Training Squadron
GNA	Goldwater-Nichols Act of 1986
IADS	Integrated Air Defense System
IO	Information Operations
IT	Information Technology
JCEWS	Joint Forces Command Electronic Warfare Staff
JCS	Joint Chiefs of Staff
JEWC	Joint Electronic Warfare Center,
JIEDDO	Joint Improvised Explosive Devices Defeat Organization
JIOWC	Joint Information Operations Warfare Center
JMD	Joint Manning Document
JP	Joint Publication
JTF	Joint Task Force
JUNT	Joint Undergraduate Navigator Training
IED	Improvised Explosive Device
LDHD	Low Density, High Demand
MAWTS	Marine Aviation Weapons and Tactics Squadron
MOE	Measures of Effectiveness (Also called indicators of effectiveness)
MOS	Military Operational Specialty
NAVEWS	Naval Electronic Warfare School
NCA	National Command Authority
NFO	Naval Flight Officer
NSA	National Security Association
NSC	National Security Council
NSS	National Security Strategy
OIF	Operation Iraqi Freedom
OEF	Operation Enduring Freedom
ORGCON	Organizational Consultant (Burton, *et al.* software based diagnostic organizational assessment tool)

PCS	Permanent Change of Station
PME	Professional Military Education
RCIED	Radio Controlled Improvised Explosive Devices
SEAD	Suppression of Enemy Air Defense
SECDEF	Secretary f Defense
STRATCOM	United States Strategic Command
UMD	Unit Manning Document
U.S.	United States
USAFWS	United States Air Force Weapons School

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Dr Erik Jansen, professor at the Naval Postgraduate School, Monterey, CA, conceived the concept of merging multiple system design models to refine the evaluation of command level electronic warfare (EW) organizations. Dr Jansen's outside perspective on the problem of planning and managing EW was vital to maintaining a focused and measurable analysis. Additionally, naval Postgraduate School professor, Dr Mark E. Nissen's paper, "A Computational Approach to Diagnosing Misfits, Inducing Requirements, and Delineating Transformations for Edge Organizations" presented to the 10th International Command and Control Research and Technology Symposium: The Future of C2," was the inspiration for doing a comparison between two events using Burton and Obel's Organizational Consultant (ORGCON) expert systems. I would also like to extend my appreciation to Col Magram and Maj Berg from the Joint Electronic Warfare Center (JEWC) for their insight, cooperation, and assistance into the research and recommendations. As a final note, the observations and opinions in this thesis are mine alone and do not reflect official association with Naval Postgraduate School or individuals interviewed during the research.

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I. INTRODUCTION

> Information is the oxygen of the modern age. It seeps through the walls topped by barbed wire, it wafts across the electrified borders.
>
> - Ronald Reagan, June 14, 1989

A. PURPOSE

The purpose of this thesis is to analyze the United States (U.S.) military command level organizational structure within the Department of Defense (DoD) responsible for planning and management of the electronic warfare (EW) mission. Even though the U.S. military is, the best trained and equipped military in the world, there have been recent symptoms of decline in their capability to execute mission to control the electromagnetic spectrum environment (EME) and protect U.S. information. This analysis investigated the impact of the formal structure in which command level EW organizations within the EW community are tasked to manage, plan, and facilitate execution of EW operations. Successful accomplishments of these tasks are required to ensure U.S. information flow advantages in the 21st century.

B. ROLE OF ELECTRONIC WARFARE

Joint Publication (JP) 1-02, *Department of Defense Dictionary of Military and Associated Terms* (2001, Amended 2007), defines electronic warfare as "military action involving the use of electromagnetic and directed energy to control the electromagnetic spectrum (EM) or to attack the enemy" (p. 177). EME control is the mission or strategic task of the EW community. JP 3-13.1, *Electronic Warfare*, identifies the method to achieve the task is to "exploit and attack an adversary's information flow while protecting access to and use of U.S. information" (p. V, I-2). Extending President Reagan's "information is oxygen" metaphor, electronic warfare can be viewed as the cardiovascular system responsible for exchanging and supplying the DoD body with information. The information is supplied to the hands, where soldiers and battlefield commanders thrust their tactical spears, and to the brain, where information is used to

influence international strategic policy. Regulating the information flow is essential for sustained success at the tactical, operational, and strategic levels of warfare and ultimately the national security of the U.S.

The EW mission is divided into three missions: Electronic Warfare Support (ES), Electronic Attack (EA), and Electronic Protect (EP). ES is responsible for searching, intercepting, identifying, and locating adversary information. EA is charged with attacking adversary equipment, personnel, and facilities with intent to degrade, neutralize or destroy adversary capabilities to share information. While EP is assigned the task of protecting American equipment, personnel, and facilities associated with providing U.S. information against adversary EA efforts (JP 3-13, p. II-4). Information flow is defined as information transmitted from one source (sender) to another (receiver) over some channel (Denning, 2007). The laws of physics constrain information channels to the electromagnetic spectrum environment[1] (EME). Therefore, EME control equates to control of the flow of information. Since the EW community is assigned the strategic task of "controlling the EME" (JP 3-13.1, 2007) its mission is to regulate the information flow. Recent events have exposed symptoms that U.S. military is unable to control the EME and regulate information flow.

C. SYMPTOMS OF ELECTRONIC WARFARE DECLINE

The U.S. Congress passed the Goldwater-Nichols Act (GNA) of 1986 in response to military deficiencies exposed during three events in the early nineteen-eighties. These events were the failed 1981 Iranian Hostage rescue attempt, the inter-service coordination and communication failures following the 1983 Beirut, Lebanon Marine barracks bombing, and the interoperability problems experienced during the 1983 Grenada mission (Parlier, 1989). The goal of the GNA reorganization was to "do a better job of employing and organizing our [American] military forces" (Parlier, 1989). The

[1] Graphical depictions of the electromagnetic spectrum and basic information on the structure and use of the EM spectrum can be found at the following link retrieved October 25, 2007 from http://imagine.gsfc.nasa.gov/docs/science/know_l1/emspectrum.html. A subcomponent of he EME most often used by the EW discipline is the radio spectrum. The radio spectrum is regulated in the U.S. by the National Telecommunications and Information Administration (NTIA). The U.S. Radio Spectrum Frequency Allocation chart can be found at the following site retrieved October 25, 2007 from http://www.ntia.doc.gov/osmhome/allochrt.pdf.

following are three indicators that expose deficiencies in the employment and organization of EW. These indicators can be viewed as symptoms that America is declining in its ability to effectively exploit, attack, and protect the EME in the twenty-first century.

The first indicator is the U.S. was not able to use ES effectively to exploit adversary information flow and subvert the terrorist attacks against the United States on September 11, 2001. Terrorists took advantage of modern communications technology, influence of transnational non-state actors, and the loss of distinction between military and civilian targets to exploit U.S. vulnerabilities in controlling the information flow. (Shultz Jr., Richard H. & Beitler, 2004, p. 57).

The second indicator was exposed by the problems the U.S. military have had trying to counter terrorist use of radio-controlled improvised explosive devices (C-RCIEDs) in Operations Iraqi and Enduring Freedom (OIF/OEF) (Fulghum, 2005). Soldiers were injured and killed because the U.S. did not initially employ EA effectively to counter the RCIED. Simultaneously, an EP failure occurred because these EA systems also targeted U.S. command and control communications (Fulghum, 2007).

The U.S. government's acknowledgement of TITAN RAIN is the third indicator that can be construed as a symptom of EW inadequacy. TITAN RAIN is the original code name for the systematic intrusion into DoD contractor and military sites by Chinese based hackers (Thornburgh, 2005). The U.S. has not been able to protect electronic information systems from international intrusion.

Individually these indicators are alarming. Combined they represent cataclysmic symptoms of potential impending failure of the U.S. to execute the EW 'exploit, attack, and protect' missions (Huber, *et al.,* 2007). These symptoms of EW decline was the catalyst for this thesis.

D. THESIS ORGANIZATION

The thesis is organized into five chapters. Chapter I is the introduction where the thesis purpose is identified. This is followed by a brief discussion of the mission and

tasks of electronic warfare assigned by the Department of Defense and formalized in joint publications. Additional examples are provided to illustrate symptoms of the EW decline that can affect national security. Finally, research methodology and rationale for focusing the research scope to an analysis of command level EW organization within the EW community is discussed.

Chapter II provides the reader a brief literature review on organizational design and introduces a combined open systems model developed for this analysis. The model is developed by incorporating components of the "Leavitt Diamond" (1965) model and the Mercer Delta presented Congruence model developed by Nadler and Tushman (1998). Components of the model and key terms of organizational design are identified and defined in this chapter.

In Chapter III, the current structure of command level EW organizations are placed into the context of the combined open systems model. Information from joint publications, Department of Defense instructions, and interviews with personnel in command level EW staff positions are used to place command level EW organizations in the context of the model.

Chapter IV is the analysis of the "fit" or congruence between components within the model. The terms fit and congruence are used synonymously in the thesis. Nadler and Tushman (1998) define fit as:

> Determining how the various internal and external variables related to an organization interact and adapt to achieve the output goal of the organization. These variables include the external operating environment and internal organizational components of work, people, structure, technology, and strategy. (p. 9)

Analysis for command level EW organizations iss conducted by assessing the fit between components based on the contextual information identified in Chapter III. This analysis is based on joint publication defined structure and formalized tasks, historical review of inputs affecting EW, and interviews with JEWC personnel. In conjunction with the combined open systems model analysis, Burton and Obel's (1998) diagnostic software package, Organizational Consultant (ORGCON), is used to determine the organizational

fit. The ORGCON analysis is performed using two different periods to determine if the organization has effectively adapted to the dynamic environment. The first period analyzes the structure of the joint EW community as it existed between 1986 through the end of the 1991 Gulf War. This fit analysis is then compared to the second period extending from post 1991 Gulf War to today's twenty-first century environment.

Finally, Chapter V contains observations from the fit analysis and provides recommendations for the organization. These recommendations are necessarily limited and are suggestive. They are based on limited resources and a moderate level of knowledge of the joint manning documents, training procedures, and mission requirements. However, they should be sufficient to provoke discussion.

E. RESEARCH SCOPE

The lens used to focus the research is organizational contingency theory (Donaldson, 2001). "Fit" or congruence between components of command level EW organizations within the DoD structure was examined. Analysis was focused on determining the organizations ability to effectively adjust to dynamic changes in resources, technology, and environment. Command level EW organizations are defined, for this analysis, as components responsible for operational level management and planning of EW. These components include Joint Command EW staff (JCEWS) at regional unified combatant commanders (COCOM) and/or Joint Task Force (JTF) Commander headquarters; any variation of an EW Coordination Cells (EWCC) established by these commands; members of the Joint Electronic Warfare Center (JEWC) at Lackland Air Force Base, San Antonio; and the individual U.S. Air Force (AF), Navy, Marines, and Army service branch command level EW staff. Figure 1 represents the DoD structure for command level EW organizations. The black cells represent the main command level EW organizations assessed. Military components executing the physical missions of EW and operating the EW widgets are referred to as tactical EW or EW operators. Command level EW organizations and EW operators work together to try to accomplish the strategic task of EME control.

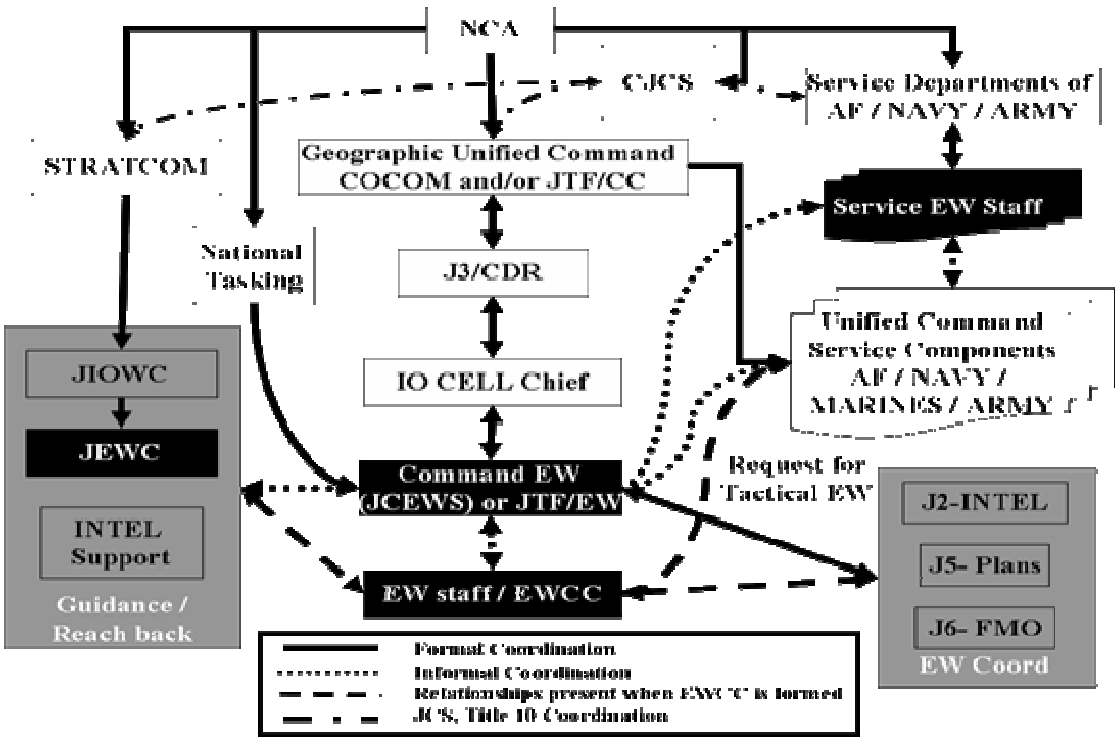

Figure 1. Joint Structure of the Command Level Electronic Warfare Organization (Derived from Joint Publication 3-13.1 Electronic Warfare, 2007)

Martin Libicki (1995), from the RAND Corporation, declares that DoD's assigned strategic task of controlling the EME is impractical and "self-defeating" (Ch.11, p. 3) Libicki (1995) says it is counterproductive because "in all aspects of EW, supremacy will only be local and thus have tactical implications at best" (Ch. 11, p. 2). This declaration means the entire EW community has been tasked to accomplish a mission that is physically unachievable in today's information age. Evolutions in information technology (IT) have led to massive quantities and variation of inexpensive, yet powerful information systems that operate over a wide spread of the electromagnetic spectrum. Additionally, changes in warfare and lower equipment costs have led to the merger of military and commercial information systems. This merger has obscured the distinction between friendly and adversary systems. This merger further complicates the tasks of EW. Even though the analytical focus is on EW planning and management at the command level, the impractical strategic task of spectrum "control" consistently affects their ability to accomplish the mission. The strategic task drives DoD strategy, program

management, acquisition, and tactical employment of EW. Implications of the strategic task of EW is discussed only on a limited basis because the analytical focus remains on command level EW organizations and their task to plan and manage

The analysis is limited also to the DoD defined formal structure of command level EW organizations. This limitation removes the variable created by "informal organizations." Informal organizations are defined as the "pattern of processes, practices, and political relationships that embod[y] values, beliefs, and accepted behavioral norms of the individuals that work for the company" (Nadler & Tushman, 1998, p. 8). Informal organizations are developed to circumnavigate inadequate or irrelevant formal processes or structures. This flexibility to avoid inadequate formal processes makes informal organizations powerful.

Successful formal organizations that effectively adapt to dynamic environments harness this power. Informal organizations assessed as effective are incorporated into formal structure based on their successful adaptation to changes in inputs, work, strategy, and people. (Lawler, Edward E. Worley, Christopher G., 2006, p. 120). The rationale for excluding the informal organization in this analysis is to minimize internal dynamic components of an organization. Informal organizations can mask formal organizational design flaws.

The goal of this analysis is to evaluate if the formal structure of the command level EW organization is designed for success in the twenty first century. Executing a structural analysis limits the investigation into the effect of military human resource management. Including human resource management would provides insight into the impact of personnel selection, placement, promotion practices, rewards, performance appraisal, training, and education on the militaries ability to accomplish the mission (Burton *et al.*, 1998, p. 111). Aspects of training, job placement, and education are discussed on a limited basis as they affect the structural components, but they are not the focus of the analysis.

The analysis is chronologically restricted to the last twenty-one years. The current formal command level organizational structure was established within DoD by

the 1986 Goldwater-Nichols Act. Over these twenty-one years, significant developments in the evolution of communication technology, warfare and international political events created a natural break following the 1991 Gulf War. Developments that created the natural chronological break in 1991 for assessment of command level EW organizations are identified in Chapter III.

The Oxford Handbook of Organizational Theory (2003) states "traditional command and control forms of organization that predominated in the twentieth century industry failed to respond quickly and creatively enough to the developing demands of consumers and to emerging market opportunities (p. 558)". The DoD is organized as a traditional command and control (C2) structure. This analysis focuses on the EW component of the DoD C2 structure to determine the EW's ability to adapt quickly and creatively to external changes. In 2006, the National Security Strategy established a direct correlation between information flow and national security (p. 47). Since EW is responsible for controlling the EME and information flow, if it fails to adapt "quickly and creatively" to the environment, national security could be at risk. The aforementioned examples of EW deficencies are symptoms that the organization may be stagnant and unable to adapt to the dynamic twenty-first century environment. *The Oxford Handbook of Organizational Theory* (2003) warns organizational stagnation can result in a "future of declining power and influence" (p. 562). In an attempt to minimize any decline of American power and influence in the twenty-first century, this theoretical analysis of the command level structure of EW within the DoD organization is presented.

II. OVERVIEW AND BASIC CONCEPTS

> If we are organized to do one mission, it means we are not organized to do all missions.
>
> – Dr. Gordon H. McCormick, July 5, 2007

A. THEORETICAL REVIEW OF THE OPEN SYSTEMS AND CONTINGENCY MODELS

Two open systems models are combined to structure the organizational analysis of the command level EW organizations. Results are used in conjunction with analyses from Burton and Obel's (1998) Organizational Consultant (ORGCON) expert system to assess command level EW organizational structure. The following is a brief review of these models.

Conceptualized in the nineteen fifties, the organizational application of theorist Ludwig von Bertalanaffy's (2003) open systems model focuses on determining how an organization maintains its ability to achieve its goal while adjusting to dynamic changes in external and internal events. The theory has four main assumptions. First, the intent of any organization is to maximize efficiency in achieving its goals. Second, modern day organizations cannot be closed. Environmental influences including energy sources, communication networks, product or service delivery, political demands, and financial constraints require organizations to adapt and respond to its environment. Third, large organizations are "comprised of multiple subsystems, each of which receive inputs from other subsystems and turn them into outputs for use by other subsystems" (Nadler & Tushman, 1998, p. 6). And fourth, a failure in one subsystem does not mean failure for the whole organization.

The combined open systems model developed for this analysis integrates elements of the "Leavitt Diamond Model" and the "Nadler-Tushman or Mercer Delta Congruency Model." The Leavitt Diamond was presented in Leavitt's (1965) paper "Applied Organizational Change in Industry: Structural, Technological, and Humanistic Approaches." Organizational theorists Nadler and Tushman developed the Congruency Model, which later was modified slightly by Nadler's consulting firm: Mercer Delta

(1998). The combined open systems model is the primary means for organizing the analysis of command level EW organizations. Components of the combined systems model and definitions of key terms are discussed in the next section.

Contingency theory co-evolved with the open systems theory. In *Organization Design* (1977), Jay A. Galbraith explains that organizational contingency theory postulates that (1) there is no best way to organize and lead or make decisions in an organization and (2) not all organizations are equally effective. Determining external fit issues between the organization and the environment, as well as identifying the internal fit issues between organizational subsystems is required to identify 'better' organizational designs (Galbraith, 1977, p. 28-29). Research into contingency theory has begun to develop a set of propositions about congruent relationships. These provide a foundation for making design recommendations based on factors such as size, technology, strategy, environment, and management preferences (Burton *et al.*, 1998, pp. 14-15). Organizational theorists, Burton and Obel, developed the expert system ORGCON software that is based on these propositions (Burton *et al.*, 1998).

ORGCON is designed to provide a general diagnostic analysis of an organization. An ORGCON analysis is based on the answers to multiple-choice questions posed by the expert system to assess the values of specific variables. These specific variables relate to propositions identified in contingency theory such as organizational structure, climate, environment, and personnel. ORGCON' questions ask for a confidence level for each answer. Since the system is designed for analysis of a wide range of organizations, the system allows the operator to respond "not applicable" to questions that do not apply. Including the confidence level for each response enables the system to weight responses when conducting the analysis. Appendix E contains a list of questions posed by the ORGCON and includes the responses selected for this analysis. ORGCON's output is a fit analysis with design recommendations[2]. This thesis includes the ORGCON

[2] Execution of the analysis using the software is relatively simple; however the theory behind the design of the software is rather in-depth. For more information reference Burton and Obel *Strategic Organizational Diagnosis and Design: Developing Theory for Application*, 2nd ed., Kluwer Academic Publishers, Boston, 1998.

diagnostic tool to provide a second analytical approach. It is used to evaluate the external and internal congruence of the command level EW fit at two periods in time: before and after the 1991 Gulf War.

B. COMBINED OPEN SYSTEMS MODEL COMPONENTS, KEY TERMS, AND DEFINITIONS

As discussed earlier, the combined open systems model used integrates the "Leavitt Diamond Model" and Nadler and Tushman's (1998) "Congruence Model". The model has three main components: inputs, outputs, and the transformation core. Within the transformation core are the four subcomponents of task, people, formal structure, and technology (See Figure 2). The following definitions of key terms describe the organizational structure and model components.

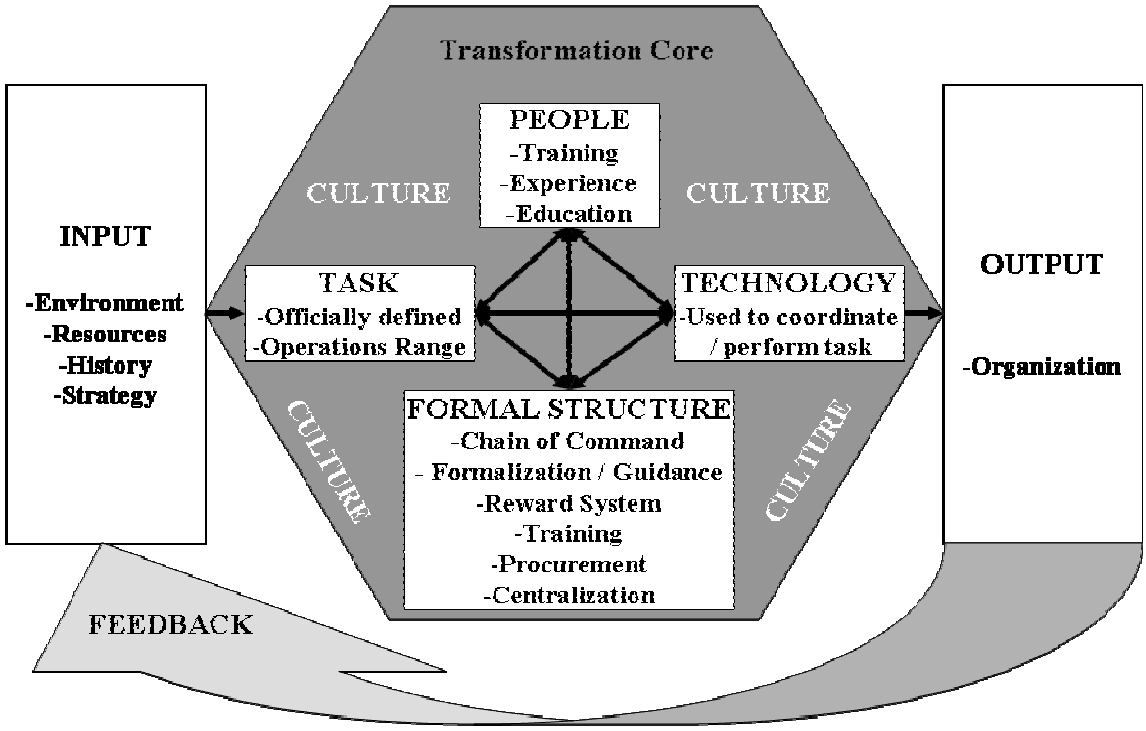

Figure 2. Combined Open Systems Model (From "Congruence Model" by Nadler & Tushman, 1998, p. 8 and "Leavitt Diamond" by Leavitt, 1965)

1. Organizational Configuration and Structure: Key Terms

DoD structure of command level EW organizations can be described as a professional machine, which is a hybrid of a machine bureaucracy and a professional bureaucracy. This professional machine has a divisionalized, formalized, hierarchical form that operates in a complex and predominantly dynamic environment. Definitions for these descriptive terms are provided below and are based on Henry Mintzberg's congruence structure model.[3] Appendix B contains a comprehensive summary chart of Henry Mintzberg's congruence structure developed by Erik Jansen at the Naval Postgraduate School.

> **Bureaucracy**: Administration of a government chiefly through bureaus or departments staffed with non-elected officials. (bureaucracy (n.d.), 2007).
>
> **Hierarchy**: Any system of persons or things ranked one above another. Organizational structures with multiple layers are considered hierarchical. (hierarchy (n.d.), 2007)
>
> **Formalized:** The quantity of written rules and procedures in an organization. A highly formalized organization will have a lot of written rules and procedures which are followed relatively strictly. Standardization can be by position where specifications are attached to the job itself; by the work flow, where specifications are attached to the work itself; and by rules and regulations, seen in policy manuals. (Burton *et al.*, 1998, pp. 5, 24)
>
> **Machine Bureaucracy**: This bureaucracy is characterized by organizations where important decisions are made by the strategic apex or executives of the company. Daily operations are managed by middle level personnel following standardized procedures. There are many layers between the operating level or core of workers and the executive apex. Operations have a large support staff responsible for training and providing services like budgeting and human relations. Additionally, a sizeable technostructure is responsible for establishing and maintaining

[3] Mintzbergs congruence structure model has five parts: Strategic Apex, Middle Line, Operating Core, Support Staff, and Technostructure. The Apex is responsible for determining mission and shape of organization. Middle line focuses on management of internal operations. Operating core executes daily tasks to accomplish the mission. Support staff facilitates work of the core by providing training, administrative procedures, and services. While the technostructure is responsible for establishing procedures, adapting to the environment, and evaluating output compared to the mission. For more information reference: Mintzberg, H. *The Structure of Organizations*. Upper Saddle River, N.J.: Prentice Hall, 1979.

standards, as well as adapting to environment. These layers are proportional in size to their role within the organization. This type of structure is efficient and effective, however motivation and creativity is low. An example of a machine bureaucracy is the McDonalds, corporation. (Bolman & Deal, 2003, p. 75)

Professional Bureaucracy: This bureaucracy is characterized by a moderate apex responsible for a large operating core. The operating core is professionally trained, indoctrinated, and adhere to professional standards therefore there are few middle levels of management and a small technostructure. The structure is flat and usually demonstrates decentralized control. Coordination is difficult. The professional training keeps the individual at the forefront of their specialty; however the overall organization usually responds slowly to external changes. An example of a professional bureaucracy is any large U.S. University or hospital. (Bolman & Deal, 2003, p. 77)

Divisionalized Form: This structure is characterized as a large company with all five core components described by Mintzberg; however the operating core is divided into separate divisions all of which contain a smaller scale of the five core components. Described as "quasi autonomous units," the divisions can be divided along product, geography, or specialty lines. Benefits of the divisionalized form are economies of scale and responsiveness to changes in local external inputs. Negative effects include power struggles between division level apex and headquarters and headquarters being unresponsive to divisional requirements because they have lost touch with operations. An example of a divisionalized form is a multi-campus university, multi-specialty hospital, or a Fortune 500 company with multiple products and locations like Proctor and Gamble. (Bolman & Deal, 2003, p. 77-78)

2. Combined Open Systems Model Components

Inputs, outputs and the transformational core are the three main components of the combined open systems model. Inputs are further divided into the following five impact factors: environment, resources, history, strategy, and feedback. The output component for this model considers the performance of the organization as a whole. Feedback assessing the organization's achieved outputs is returned as an input factor. In this model the overall organizational output has been adjusted to the planning and management of EW instead of the strategic task of controlling the EME because of Libicki's (1995) observation that the strategic task of control is unrealistic and "self-defeating" (Ch. 11, p. 3). The final aspect of the model is the transitional core, which

contains the sub components of task, people, formal organization, and technology. The following are definitions and descriptions of these components.

Output: The output is discussed first because it is the "ultimate purpose" of an organization. Nadler and Tushman state that the outputs:

> encompass the products and services produced as well as the effectiveness of the organization to produce the output. Output is further divided into total or goods/services produced; units within a system or how each subdivision of an organization achieved its goals in contributing to the total output; and individual or behavior and performance of the people within the organization (Nadler & Tushman, 1998, pp 6, 7).

This analysis identifies the goal for command level EW organizations to manage and plan EW to control the EME. Organizations assess outcomes. Assessments are fed back into the system and are considered another input. Feedback mechanisms comparing outputs to mission goals are used to determine effectiveness.

Feedback: Feedback is defined as "the return of a portion of the output of a process or system to the input, especially when used to maintain performance or to control a system or process" (feedback (n.d.), 2007).

Many times a significant loss or a crisis is required for an organization to initiate feedback and assess the transformation process (Lawler, Edward E. Worley, Christopher G., 2006, p. 3). Successful organizations that achieve or exceed goals use feedback to assess the transformational process. John Boyd, in *The Essence of Winning and Losing* (1996), presents the observe-orient-decide-act feedback process model (See Figure 3).

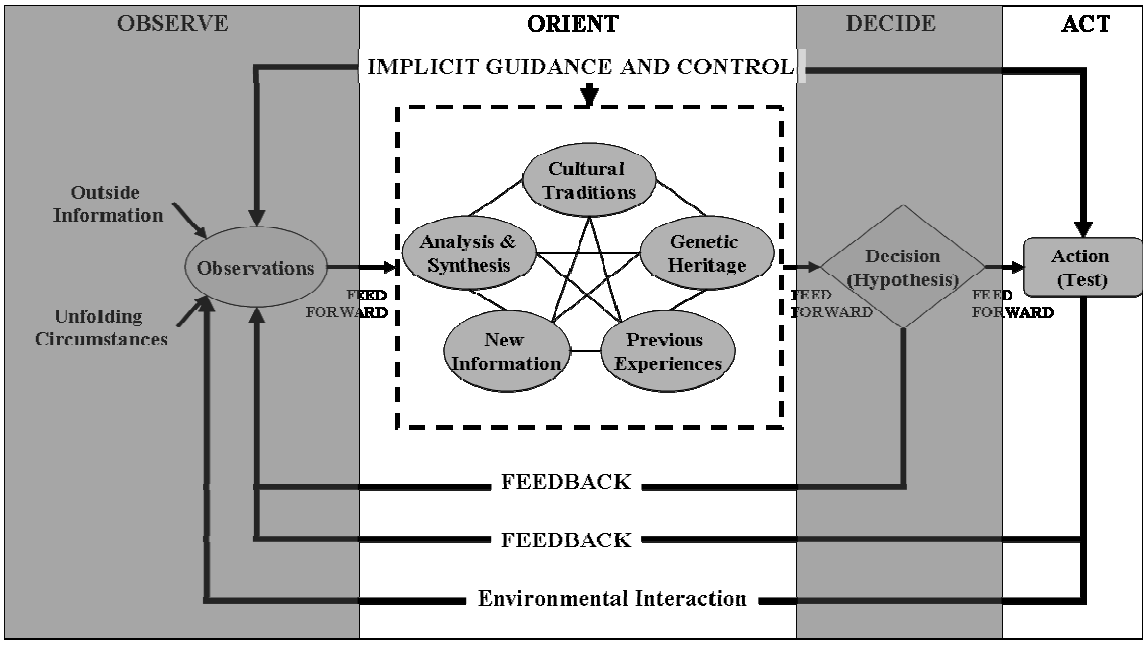

Figure 3. John Boyd's OODA Loop (Created from John Boyd's brief "The Essence of Winning and Losing," 1996)

Also known as the "OODA-loop," this model is often used by the U.S. military to assess tactical operations. Observed results of feedback are factors that affect the input component.

Input: Inputs are all the "givens" or raw materials of information and influences that the organization must manipulate to perform its work or task. Output feedback is combined with the four input factors to define the dynamic external influence that the organization must adapt to in order to be successful. The four input factors are presented as follows:

Environment: The environment affects demands, constraints, and provides opportunities to organizations. These opportunities are based upon the operating market, technological and economic conditions, competition, and authoritative bodies that provide oversight and regulations (Nadler & Tushman, 1998, pp. 3-4). The environment includes the technology available to execute operations, how the competition uses the available technology, and changes in conduct or rules governing operations

History: Historically "the way an organization functions today is greatly influenced by landmark events that occurred in the past" (Nadler & Tushman, 1998, p. 5). The history described in this part is restricted to the history of the organization. This includes how it has traditionally operated, structured, and responded to changes.

Resources: Resources include tangible assets like employees, money, and technology, as well as intangible aspects like reputation and organizational climate (Nadler & Tushman, 1998, p. 5). Resources for this discussion are divided into two categories. The first category is organic resources used by the U.S. to conduct EW operations. This includes people and the EW technology used by the tactical level operators. The second category is the information system resources available for use by adversaries.

Strategy: The values, beliefs, and behaviors of an organization are based upon history and shape the strategic path chosen by leadership. Strategy is further divided into corporate and business. Corporate strategy focuses on output, which is what the organization will produce. Business strategy deals with how the organization will configure and utilize the resources to achieve the output (Nadler & Tushman, 1998, p. 6).

Transformation Core: The six input factors are refined in the transformational core to produce outputs. People, tasks, formal structure, and technology comprise the transformational core component. Interactions between the core's subcomponents are continuous and inter-dependent. In standardizing this organizational analysis, the transformation core is discussed in the following order: task, formal structure, people, and technology. The rationale for this order is that inputs affect the task; task are accomplished within the formal structure; people are assigned by the structure to accomplish the task; and people use technology provided by the formal structure to execute the task. All of the transformational core components are impacted by and contribute to organizational culture. Optimally, these components are developed, executed, and then modified based on feedback of the organization achieving its goal. The following are definitions for the transformation core components.

Task: Task is defined as the "basic and inherent activities engaged in by the organization, units, people to achieve the strategy" (Nadler & Tushman, 1998, p. 7). The tasks for command level EW organizations will be restricted to the tasks formalized in DoD instructions and publications.

Formal Structure: Nadler and Tushman (1998) define formal organization as "structures, systems, and processes" designed to coordinate people and work to achieve the strategic goals (p. 8). This includes formal training, written procedures, divisions of labor, and the organizations physical layout.

People: The term 'people' is used to describe the characteristics of people hired by the organization to produce the output. These characteristics include experience, knowledge, skills, and motivations (Nadler & Tushman, 1998, p. 8).

Technology: Technology in the transformation core is defined as the available resources provided by the organization to execute the mission. Core technology is the tools provided to command level EW organizations to plan and manage EW. This is different from technology inputs.

Culture: Edgar Schein defines culture as "the pattern of basic assumptions developed by a group in learning to cope with problems of external adaptation and internal integration. These assumptions are considered valid enough to be taught to new members as how to perceive, think, and feel in relation to problems" (Robey, 1986, p. 426). Culture reflects organizational values, beliefs, and behavior patterns.

3. Analysis Methodology

Two methods are used to conduct this analysis. The first method uses the combined open systems model as a framework to determine fit or congruence between the transformational core subcomponents. The more aligned or congruent the component relationships are in organization, the more likely the organization can succeed in achieving its output goal (Nadler & Tushman, 1998, p. 9). Fit is assessed by

systematically examining potential issues between the various sub-components of the transformation core. Table 1 is the fit-issue assessment chart, derived from Nadler and Tushman (1998) that provided the framework for the analysis.

Fit	The Issues
Task - Organization	Are organizational arrangements adequate to meet the demands of the task; whether organizational arrangements (including staffing, training, budgeting, technology) tend to motivate behavior consistent with task demands
Task - People	What extent people have skills, ability, and authority to meet task demands; to what extent are needs of individual met by the task
Task - Technology	What extent does task require technology, how does technology impact execution of task
Organization - People	What extent do people comprehend organizational structures; what extent are people's needs met by organizational arrangements (includes training for task and technology); convergence of individual and organizational goals
Organization - Technology	What extent does the organization use technology to accomplish mission; how responsive is organization to technology changes, how does technology improve or hinder organization structure
People - Technology	What extent does technology meet needs of people to accomplish task; what extent are people aware/able to use and/or respond to changes in technology

Table 1. Transformation Core Components "Fit-Issue" Assessment Chart (Adapted from Nadler and Tushman, 1998, p. 9)

Research into Joint publications, events in EW history, and interviews are used to place the command level EW organization into the context of this model. After completing the model context, the organizational fit issues are identified and analyzed for congruence. A quick reference fit-issue assessment chart is developed for the command level EW organization based on the contextual analysis. Results of this approach are used in conjunction the second method of analysis to develop conclusions.

The second analytical approach uses Burton and Obel's (1998) expert systems ORGCON software. ORGCON is used to determine the adaptability of the command level EW organization to dynamic inputs over time. The time analysis is divided into two periods. The first period ranges from 1986 until after the 1991 Gulf War; the second period includes 1991 to the present day. The rationale to separate the analysis into these

time frames is discussed in Chapter III. The input to ORGCON is based on the authors' responses to sixty questions posed by ORGCON that help characterize organizational structure, size, climate, environment, and personnel experience. To minimize internal variables, the responses were answered with either 100% certainty or not answered. Based on these inputs, ORGCON generated a fit analysis and provided organizational design recommendations. This analytical process was followed for each of the two periods.

Results of ORGCON's assessment were pooled with the combined open systems analysis to assess the effectiveness of design of command level EW organizations. Information derived from the analytical comparison is the basis for design recommendations. Command level EW organizations are placed into the context of the combined open systems model to conduct the assessment.

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III. ELECTRONIC WARFARE ORGANIZATION INTO CONTEXT OF COMBINED OPEN SYSTEMS MODEL

> The ability of the future force to establish an "unblinking eye" over the battle-space through persistent surveillance will be key to conducting effective joint operations.
>
> - National Security Council, 2006, p. 55

Placement of command level EW organizations into the context of the combined open systems model is extensive because of the complex and dynamic external and internal variables that affect EW planning and management. Figure 4 represents the contextual merger of EW into the model. This is the roadmap for the discussions in this chapter.

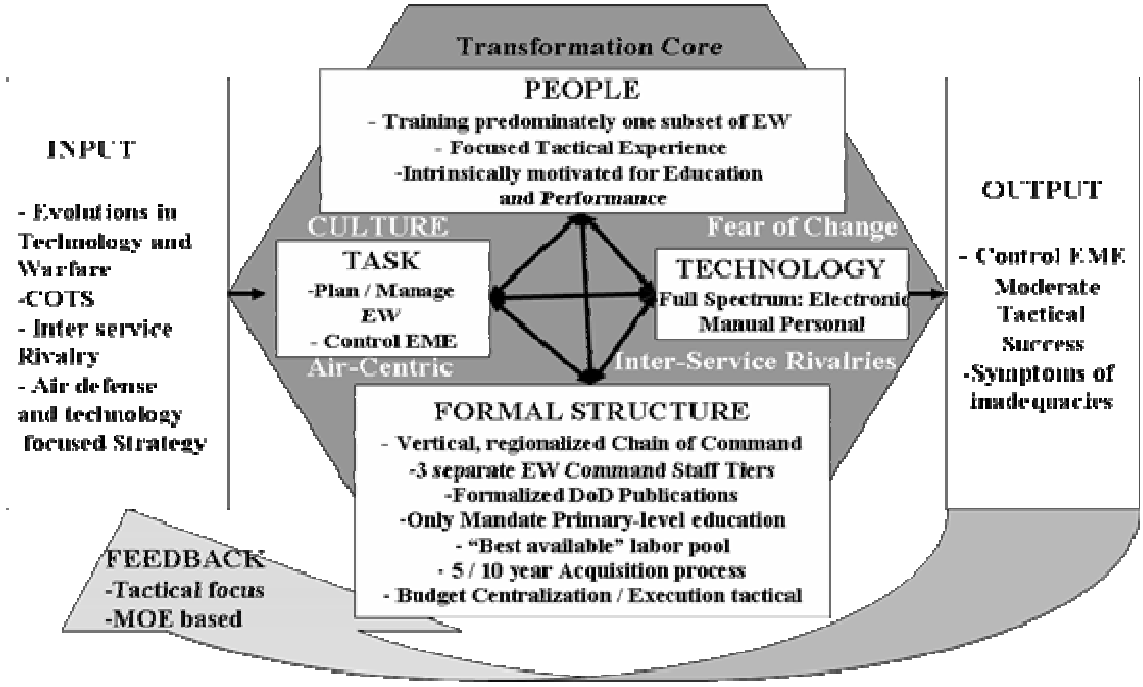

Figure 4. Command Level EW Organizations Within Context of Combined Open systems Model

A. OUTPUTS AND FEEDBACK

Placement of the command level EW organization into the context of the combined open systems model begins with the output component and associated feedback process. The recognized symptoms of EW employment and organizational deficiencies, from the introduction, are feedback observations based on an assessment of the output. Based on the definition of EW, the EW output is EME control (JP 1-02, 2001, Amended 2007, p. 177). The means to accomplish this output is to "attack, exploit and protect" the EME (JP 3-13.1, 2007, p. V, I-2). Therefore, EW's strategic task is to provide the service of EME control for the U.S. military. The task of the command level EW organization is to provide this service through planning and management of EW. Measures of effectiveness (MOEs)[4] are used to assess the organization and create formalized feedback for the command level EW staffs. Prior to discussing command level feedback, tactical level MOE issues are discussed. These tactical issues affect command level feedback.

Development of accurate MOEs for tactical EW operations is difficult for two reasons. First, MOEs can be measured in many ways and can create either positive or negative feedback. Second, the EME is an open systems which impacts assessment of communication. Communication expert Dr Wilbur Schramm (1954), states that "effective communication is achieved when the message encoded is decoded properly by the receiving party" (p. 5). Successfully encoding and decoding the messages empowers recipients with information. The problem with assessing EW operations that exploit, attack, or protect the EME, is the receiving party is hostile and does not provide direct feedback. The U.S. does not know if the signal was jammed, if all the information was exploited, nor how many attacks were prevented. Secondary indicators are used to determine EW effectiveness to compensate for the lack of direct feedback. These indicators include complaints by adversaries trying to use the EM spectrum, scheduled actions not happening, or no intrusions on U.S. information channels.

[4] MOE is also referred to as indicators of effectiveness

Tactical level MOE difficulties are amplified at the command level because tangible or quantifiable results cannot be accurately computed. Traditional military MOEs include tangible, quantifiable measurements like number of targets destroyed, sorties flown, ammunition fired, or territory occupied. The use of secondary indicators to assess tactical EW MOE results in ambiguities. These ambiguities are amplified at the command level when they are combined to produce theater level EW MOE analysis. This results in a faulty feedback process.

Feedback is also affected by the inter-service rivalries designed into the DoD bureaucratic structure (Zegart, 1999, pp 8, 155). Budgets of the individual services are based on the systems and programs they operate. If a particular system is effective, the service will receive additional money (OSD iCenter, 2007). This competition for money creates inter-service rivalries. Since MOEs can be measured in many ways, services will either delay feedback or select MOEs that are favorable to their own EW system. Service use of biased MOEs is an attempt to influence congressional budget allocations for their individual EW programs. The impact of biased feedback fueling inter-service rivalries over budgets and systems was exposed recently during the Army and Marine acquisition battles over C-RCIED equipment (Atkinson, 2007). Impact of the inter-service rivalries and the budget process is discussed further in Chapter IV.

Feedback at the command level is incorrect, inconclusive or missing because of tactical MOE ambiguities and bureaucratic induced delayed and/or biased feedback. Feedback issues and poor adjustment to feedback at the command level equates to inconsistent long-term management and planning of EW. This means two things. One, EW requirements are not prioritized correctly or equipment distributed appropriately; and two, EW systems required on the future battlefield are not acquired today. Feedback inconsistencies negatively impact the mission at the tactical level. The introductory events interpreted as symptoms of EW decline in the twenty-first century reflect this statement. These symptoms are acute and must be addressed if the U.S. is to maintain its military information advantage. Feedback assessment is combined with input factors to define the external dynamic environment. in the combined open systems model.

B. INPUTS

After the collapse of the Soviet Union in 1989, the U.S. assumed the role of hegemonic superpower. By the conclusion of the 1991 Gulf War, the U.S. had globally demonstrated its technological superiority in war, political dominance over the Soviets, and economic savvy with a string of seven consecutive years of substantial growth (United States Central Intelligence Agency (CIA), 2007). It was also at this time that significant developments occurred in technology and warfare that impacted EW. These developments are divided among environmental, historical, resources management, and strategic factors. These are the remaining four input factors of the model.

1. Environment

Many factors shape the environment. Arguably, the most significant to command level EW tasks is information technology and its relevance to military operations and warfare.

Information technology grew slowly throughout most of the nineteenth and twentieth centuries. However, an exponential increase in capability, availability, and affordability in information systems has been experienced since 1991. At the start of the American Civil War, the telegraph was capable of transmitting thirty words per minute, today the computer is capable of transmitting 1.5 trillion words per minute as well as audio, pictures, and streaming video (Najman, 1998). Appendix C contains a chronological list of significant accomplishments in technology related to EW.[5] The rapid growth in information capacity is attributed to the microchip and microprocessor. Following the invention of the microprocessor by Robert Noyce in 1968, the speed and diversity of communications technology increased, while the cost and size decreased by a factor of "one million to one" (Bellis, 2007). In 1965 futurist Gordon Moore (1965) published his observation that information technology, to include computing power,

[5] Three sources for historical review of EW and information technology systems recommended by the author are: Alfred Price *The History of U.S. Electronic Warfare*, Association of Old Crows, Arlington, VA, 1984; Ron Schroer "Electronic Warfare" *IEEE Aerospace and Electronic Systems Magazine.* Vol 18, issue 7, July 2003, p (49-54); and Naval Post Graduate School thesis by Ali Can Kucukozyigit "Electronic Warfare (EW) Historical Perspective and its Relationship to Information Operations (IO)-Considerations for Turkey". Monterey, CA, 2006.

availability, and affordability, would grow exponentially[6] This simple observation is now known as Moore's Law of Technology. Figure 5 illustrates Moore's Law in relation to the cost and availability of EW systems since the invention of the first EW system- the telegraph in 1837.

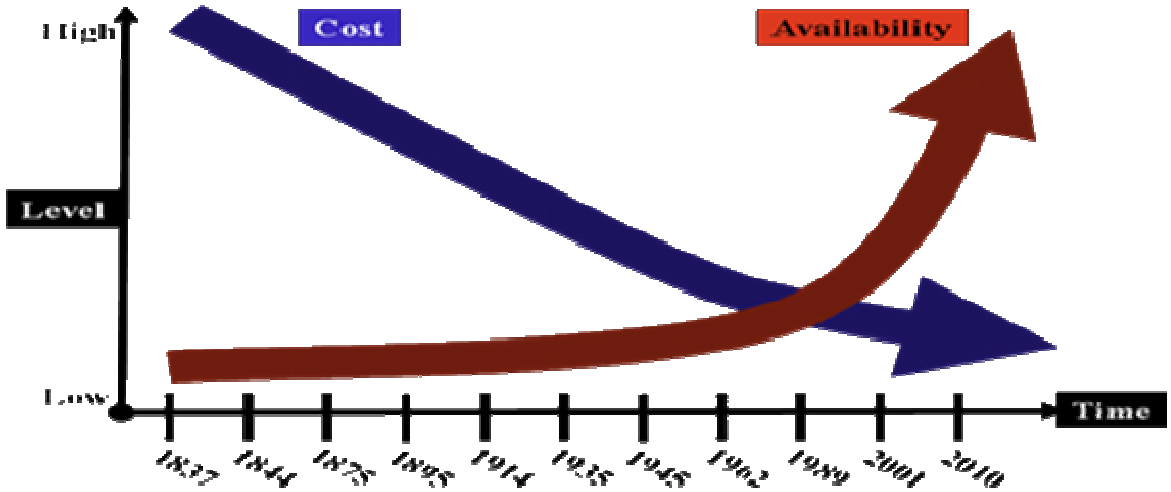

Figure 5. Interaction of Technology Evolution on Cost and Availability of EW systems between 1837 and 2007 (Derived from multiple sources and reflective of History of EW found in Appendix C)

To accommodate these new, powerful information systems, the use of the electromagnetic spectrum has also expanded. In the 1990's the wide spread use of personnel computers, cellular phones, and internet rapidly rendered obsolete traditional communication and storage means supplied by typewriters, file cabinets, mail, and land line telephone calls. Harvard Business School professor Clayton M. Christensen coined the term "disruptive technology" to describe the rapid replacement of traditional means of performing a task (Christensen, 1996). The persistence of disruptive technologies in

[6] Moore's Law has been added to by contemporary futurist Ray Kurzweil. Kurzweil's law of acceleration describes the growth as a system of evolutionary process which means the exponential growth of the technology evolution is also a component of the exponential growth of the human system. This means the growth of the system as a whole is accelerating because there is a second order exponential effect. See: March 7, 2001 post on Law of Accelerating Returns" retrieved September 26, 2007 from www.Kurzweilai.net.

information's systems over the last fifteen years has significantly shaped how humans communicate and store information. Organizational analysts Robert Naismith and Patricia Aburdene describe this phenomenon as a "megatrend" (Aburdene, 2006).

The U.S. military took advantage of the megatrend in information technology in the middle 1990's. Allen Levesque, a staff scientist from General Telephone and Electronics, observed that by the end of the Cold War, the government acquisition process for military C2 and information systems became too slow and cost prohibitive (Levesque, 1998, p. 438). Forced to decrease personnel and budget following the Gulf War, the United States military aggressively pursued better and cheaper Commercial-Off-the-Shelf (COTS) technology for its communication and electronic warfare requirements (RTO/NATO, 2000). Eventually, the commercial and military systems were merged. John Stanton in the June 2004 issue of National Defense states the U.S. military has increased the integration and dependence of the military on COTS technology to minimize cost and maximize effectiveness (pp. 14-1-14-5 and Kerr & McCarthy, 2000). Prior to the integration of COTS, targeting military communication and information systems was relatively easy because military and commercial targets were distinctly separated within the EME.

COTS integration has resulted in hybrid information systems used by the military for command and control. Hybridization of commercial and military information systems greatly complicates the EW task of targeting hostile or adversarial systems for exploitation or attack. Problems with countering hybrid information systems were first seen in 1999 during Operation Allied Force. Allies reported difficulties in targeting technologically advanced frequency agile radios, COTS radios, computers, and cellular phones used by the adversary for command, control, and coordination of air and ground defense (Bolkcom, 2001). The U.S. military strategy shift to integrate COTS aggressively into operations following the Gulf Wars is the first of four reasons the end of the 1991 Gulf War is the time selected to divide the expert system ORGCON analysis. U.S. adversaries have also taken advantage of Moore's Law to improve their information systems. This has resulted in a generational shift in the conduct of warfare.

In 1989, Lind, *et al.* authored "The Changing Face of Warfare: Into the Fourth Generation." This article hypothesized that the combined impact of the end of the Cold War, technological evolutions, integration of commercial and military information systems, and rise of terrorist organizations with a transnational base would lead to a new or fourth generation of warfare (Lind, *et al.*, 1989). The existing or third generation of warfare is characterized by symmetric conflicts with conventional battles against state actors. Conversely, the fourth generation includes asymmetric conflicts using unconventional tactics and forces by non-state or failing state actors. These conflicts can target state or non-state actors. Figure 6 is an illustration of the different generations of warfare.

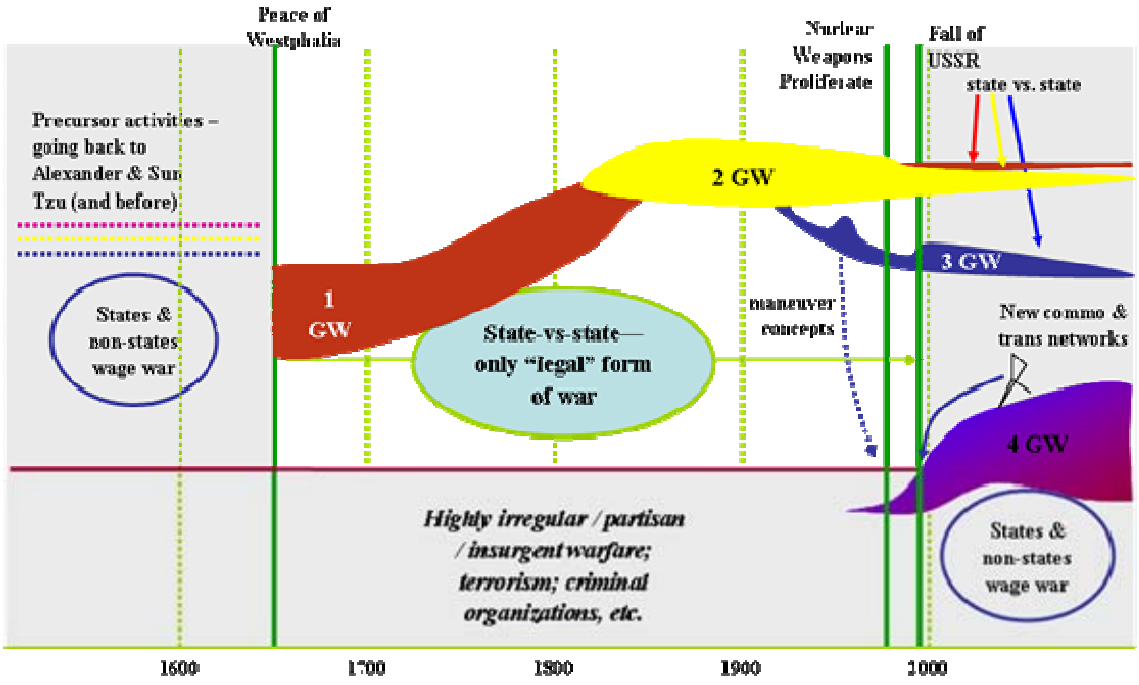

Figure 6. Evolution of Warfare from the Viewpoint of Core States and Nuclear Powers (From Chet Richards "Conflict in the Years Ahead" Presentation given in May 2005)

Lind, *et al.,*'s predictions have been verified as the rise of non-state transnational organizations using new communication technologies and terrorism tactics is the current focus of the U.S. military. Marc Sageman, (2004) in Understanding Terror Networks, describes how the Islamic transnational terror organization of Al Qaeda has executed fourth generation warfare effectively using the internet for command, control, and coordination. Internet communications facilitated the planning of 1993, 1998, 2001, and 2003 terrorist bombings in the U.S., Africa, and Europe. The internet was also the primary means Osama Bin Laden used to issue the infamous 1996 fatwa declaring war on America. The internet has also figured prominently in the current insurgency operations in Iraq and Afghanistan. Asymmetrical tactics and ideological themes are predominate descriptors of conflicts around the globe since the end of the 1991 Gulf War (McCormick, 2007). Asymmetrical tactics; increased computing power; and the hybridization of commercial and military information systems have negated the information advantage once reserved by powerful nation states. Emergence of the fourth generation of warfare following the end of the Gulf War is the second reason 1991 is chosen as the year to separate ORGCON analysis.

2. History

Like any organization with over twenty years of success, the history of the DoD structured command level EW organization is extensive and diverse. This section is narrowed to the historical perspective of classifying EW systems and inter-service rivalries on the management and planning of EW.

Historically, the capabilities and tactical equipment executing EW operations have been classified to restrict access. Restricted access is required to ensure security of EW systems and products. EW system capabilities exposure can severely degrade the information advantage and threaten national security (Lowenthal, 2000, p. 11). Highly classified World War II EW efforts include Sir Watson-Watts development of Radio Detection and Ranging (RADAR) (Price & Association of Old Crows, 1984, p. 7) and the breaking of the German ENIGMA and the Japanese MAGIC codes. These EW

events were shrouded in secrecy, but are credited with providing the allies a substantial information advantage that led to victory in 1945 (Jones, 1978). However, there are two problems caused by the restricted access to EW.

The first problem is restricted access. Corporate knowledge on the systems and information produced by the systems is restricted to those that have access. According to Mintzberg, organizations with sections that have restricted access create an internal hostile environment and virtually restrict information into pockets or stovepipes, which hinders organizational effectiveness (Mintzberg, 1979). The second problem is limited accessibility of information. Restricted access means a smaller organization and pool of experts. This smaller group is suspect to group think and cultural biases found within a small cohesive, homogenous group (Janis, Mann, & Joint Author, 1977). Cultural biases leads to inaccurate requirements and effectiveness assessments. The impact on planning and management of EW is amplified by inter-service rivalries because of these internal hostilities and biased EW assessments,.

Components of command level EW organizations are established within the structure of Joint Chiefs of Staff (JCS) under Title 10 requirements. Additionally, command level EW tasks force a close relationship with Nationals Security Agency (NSA). The history of the JCS and NSA organizations impacts command level EW effectiveness. Both the JCS and NSA were redundantly structured on purpose to ensure "competitive analysis" between organizations (Lowenthal, 2000, p. 13). Amy Zegart (1999) in *Flawed by Design: The Evolution of the CIA, JCS, and NSC* adds these bureaucratic institutions were "born out of political conflicts and compromises from self interested players" (p. 8). The result of the political conflicts and compromises is decentralized, divisional organizational structure. The rationale for this design is two-fold. First, each service was guaranteed a share in any military action, even at the "expense of overall effectiveness and efficiency" (Zegart, 1999, p. 154). Second, "a decentralized, inefficient military meant more defense spending, which leads to more jobs and votes in Congressional districts" (Zegart, 1999, p. 155). The defense budgeting process and divisional structure is the fiscal component to inter-service rivalries.

Money is divided between services and geographic command components. Each of these components must accomplish a cost-benefit analysis of internal systems and programs that drive strategy. EW systems that do not directly contribute to individual service missions or EW missions that are performed better by other agencies are cut from the budget to eliminate waste. Service scrutiny to cut individuals systems or programs is increased when Congress restricts their individual budgets. Budget and personnel decreases, imposed by Congress after the 1991 Gulf War, resulted in the pursuit of a technology focused, air-centric EW strategy. Rationale for the strategy was based on the imposed budget constraints and an incorrect assumption based on a lesson observed from the Gulf War. The lesson observed was that technology driven airborne EW would satisfy future EW requirements. The assumption was the continuation of third generation warfare tactics (Bolkcom, 2001). This rationale became the justification for the U.S. Army to eliminate the EW officer specialty code. The Air Force and Navy assumed the primary role as executors of the EW mission. The U.S. Army's elimination of the EW officer significantly contributed to the EW problems experienced by U.S. ground troops employing CRCIED measures in Iraq and Afghanistan (Atkinson, 2007). Recently, the U.S. Army has made strides to rectify this decision with the establishment of the new Army EW officer specialty code and course (Pitts, April 24, 2007).

The Army was not the only service to pay consequences for the air-centric EW strategy following the Gulf War. Each of the services followed what can be called a specialization plan. Individual services pursue EW capabilities and assets based on their specialty needs. The Navy pursued the EA-18G as a new airborne EW asset to replace the aging EA-6B fleet (Gershanoff, 2002). The Air Force has hedged its bet on the joint concept of an EW "system of systems" and the advanced electronic systems on the F-22 Raptor to satisfy future EW requirements (Fulghum, 2007). Service specific EW management has not effectively met the needs of the U.S. military because America has been involved predominantly in fourth generation conflicts. Airborne EW assets cannot effectively meet the sustained needs of the ground forces fighting asymmetrical conflicts. The 2001 Airborne Electronic Warfare report to Congress and the C-RCIED jamming problems in Iraq exposed by Fulghum acknowledge the limitations of an air-centric EW

strategy (Bolkcom, 2001 and Fulghum, 2007). The post Gulf War service specific EW efforts, which intensified inter-service rivalries, is the third reason 1991 was selected as the separation time frame to execute the ORGCON analysis of command level EW organizations.

3. Resources

Resources discussed in this section do not include the resources discussed in the transformation core's technology subcomponent. The resources discussed here are divided into three areas: (1) the actual widgets used by tactical EW operators, (2) the resources available to the adversary that uses the EM spectrum to pass information, and (3) money available to purchase widgets to counter or exploit adversary systems and protect U.S. systems.

Information technology evolutions not only have increased the total amount and variety of information systems available, but also spread coverage of the EM spectrum used to transmit the information. The large quantity and a wide variety of information systems across a wide spectrum used by both military and commercial entities in asymmetrical conflicts have significantly complicated the EW task of EME control. Command level EW organizations are forced to make important cost-benefit resource management choices because of the increased complexity. U.S. EW systems cannot cover the variety and breadth required to control the entire EME as experienced in World War II (Price & Association of Old Crows, 1984).

The historical review showed that the service branches have independently invested in tactical EW assets based on their specific missions and requirements. Most of the time, EW system acquisition occurs internally in the stove-piped service structure. This means EW systems may not be tested to determine interoperability with other systems used in joint operations. Interoperability failures can result in operational complications and even death. This is seen in the introductory examples of the Iranian failed hostage rescue and the current C-RCIED problems (Parlier, 1989 and Fulghum, 2007). Interoperability failures can be minimized through proper acquisition and testing of equipment. However, this can lead to a catch-22 situation if the acquisition process

and testing delay fielding of critical equipment. This is why the management and planning role of command level EW organizations is so pivotal to the success of operations.

Projected EW requirements submitted by tactical operators and managed by command level EW organizations initiate the acquisition process. Individual service EW staffs provide inputs to acquire widgets required to execute tactical mission using the bureaucratic DoD acquisition process. Actual acquisition and fielding of a system can take from one year, for rapid fielding, up to 20 years for the formal process (Griffard, 2002). It is likely, the widgets the U.S. purchases to execute EW operations are antiquated or ineffective by the time they are fielded. Forth generation warfare adversaries are not restricted to an acquisition process and purchases of improved COTS systems are restrained only by their operating budget.

Trying to match the adversary's acquisition process is unrealistic for America. The U.S. must operate within its allotted budget and bureaucratic constraints. The problem of trying to keep up with adversarial capabilities can be mitigated with insight into future EW development and effective management of EW systems. The different systems available around the world further compound the management of the EW problem imposed by the bureaucratic acquisition process. Information systems used in one town, country, and/or region of the world are not the same as in other towns, countries or regions. Therefore, command level EW offices are faced with the difficult challenge of trying to be flexible to respond to the latest threat while being restricted to the rigid fiscal budgeting process. The diversity and quantity of information systems available and employed by adversaries further supports the notion that the strategic task of EME control is impossible in the twenty-first century. The U.S. does not have enough organizational flexibility, resources or money to purchase all of the widgets required to execute effective EME control.

4. Strategy

Strategy is shaped by the objective goals of an organization and how that organization historically allocates resources to achieve its objectives. Joint publications

identify the EW strategic task as the "control" of the EME (JP 1-02, 2001, Amended 2007, p. 177). American Heritage Dictionary defines control as "exercise[ing] authoritative or dominating influence over" (control (n.d.), 2007). Prior to 1991, controlling the EME in military operations was less complicated because of the limited variety, quantity, and complexity of information systems as well as the isolation of military and civilian information systems. Additionally, third generation warfare delineated between combatants and non-combatants. The EW strategic task of EME control was conceived and has persevered based on these inputs factors. Derived from this strategic task was a strategy based primarily on John Warden's book *The Air Campaign* (1992): The strategy is three fold. First, exploit adversary communications to determine intentions. Second, negate a wide geographic area of early warning capabilities to detect and report a U.S. military strike. And third, deny the adversary them command and control coordination during military action.

This strategy is executed in the following way. EW efforts compliment kinetic strikes by electronically decapitating leadership command and control networks from early warning communications and the integrated air defense system (IADS). Capitalizing on the electronic decapitation of the leadership from information networks, precision air strikes using smart bombs systematically attack buildings, tanks, and infrastructure to target the will of the people. Decreasing the will of the people prepared the battlefield for U.S. ground troops to secure the land with minimal resistance. The intent was to save lives through air technology. This strategy was reinforced during the Gulf War and again during the twenty-one day combat phase of Operation Iraq Freedom in 2003. Interestingly, this strategy has proven faulty in the remainder of the asymmetrical conflicts the U.S. has been involved in since 1991.[7] This is the fourth and final reason for selecting 1991 to conduct the ORGCON assessment of the command level EW. EW Strategy has not effectively adjusted to the evolution of information

[7] Operations that the U.S. have been involved in since 1991 include, but are not limited to Haiti, Somalia, Allied Force, Operation Enduring Freedom in Afghanistan and the Philippines, and the current phase of Operation Iraq Freedom. Please reference the U.S. House of Representatives, Committee on Foreign Affairs website for more information (as accessed on October 25, 2007): http://en.wikipedia.org/wiki/List_of_United_States_military_history_events#1991-1999.

technology and warfare. Present conflicts require non-kinetic based precision strikes against a localized individual, radio, phone, or computer. This adaptation failure also is seen in the DoD EW resource allocation strategy.

As mentioned earlier, EW resource allocation is primarily military service branch based. Each service branch is responsible to fund and maintain organic EW capabilities required to execute operations pertaining to their respective mission. Since the end of the Gulf War, the Air Force, Navy, and to some extent the Marines have assumed the bulk of the specialized EW missions. These services have specific assets that can exploit, attack, and protect select systems or portions of the EME. Tactical organizations that do not have the organic capability to execute the EW mission can make a formal staff request for a capability (JP 3-13.1, 2007, Ch. IV). Requests are designed to ask for an effect instead of a particular EW system to allow the command staff flexibility to assign assets or find new equipment to meet the needs of the requestor. Strategy issues arise when requests are irrational because of the lack of understanding of EW. This irrationality is due to limited understanding of EW capabilities as a byproduct of the access restrictions discussed earlier. The irrationality may also be due to the false premise that U.S. can actually achieve the strategic task of EME control.

RAND Corporation's Martin Libicki notes in his monograph, "What is Information Warfare?" (1995), there are three problems with the strategic task of EME control. First, the strategy is faulty because the EW community is not proportioned appropriately. The strategic impact of a "large portion of the (EW) community being focused on RADAR exploitation and countering through jamming; while a small focus is placed on communication jamming" (Ch. 5, p. 1) is those developing strategy think one dimensionally. Second, the cryptography focus of breaking codes was easier when the information transmitted was analogue. Libicki (1995) says "digital encryption, bit keys, digital signatures, etc. make it very difficult" (Ch. 5, pp. 2-3). Senior strategist must break the analogue paradigm. Third, Libicki states "in all aspects of EW the supremacy will only be local and thus have tactical implications at best" (Ch. 11, p. 2). With the evolution of technology and warfare, achieving EW supremacy at the tactical level is suspect. Libicki (1995) states unequivocally that the strategic task of EW is "self-

defeating" and unrealistically defined (Ch. 11, pp.2-3). Again, this strategic debate is not the focus of the analysis; however, it does impact the command level EW organizations responsible for planning and management of EW. The impact is addressed in the analysis and recommendation chapters. Strategy is the last of the five inputs used by the transformation core to create an output.

C. TRANSFORMATION CORE

Input factors from the feedback process, environment, history, resources, and strategy are refined into an output in the transformation core. Placement of the command level EW organization into the context of the transformation core component of the combined open systems model is organized as follows: task, formal structure, people, and then technology. The rational for this order is DoD publications formalize tasks within the defined structure. People use technology to execute these tasks. JP 3-13.1, Electronic Warfare, is the primary publication used to place the organization into the context of the model. This starts with task identification.

1. Task

The task of command level EW organizations is to plan and manage EW operations to achieve the DoD directed desired output of EME control. Even though all of the agencies that comprise command level EW organizations are important, the JCEWS is the pivotal component that plans and manages EW. JCEWS are the middle organization between the senior staff, which controls the money, and the operators that execute the tactical EW mission. Based on the vision of taking the "EW fight to the enemy," specific tasks of the JCEWS are identified in Joint publications (JP 3-13.1, 2007, p. F-2).

JP 3-13.1, Electronic Warfare (2007), defines the JCEWS role is to

> engage in the full range of EW functions to include peacetime contingency planning, the day to day planning and monitoring of routine theater EW activities, and crisis action planning in the run-up to contingencies in preparations for EW as part of emergent joint operations. (p. IV-1)

This is accomplished through identification of EW missions and tasks to service or functional component commanders in order to facilitate planning of EW resources requirements and accomplish pre-coordination measures necessary to deploy and employ EW resources in foreign countries (JP 3-13.1, 2007, p. iii-9).

Over thirty individual tasks, covering all aspects of EW, are formalized in the joint publication for JCEWS to accomplish (See Appendix D). Additionally, chapter four provides ten pages of coordination considerations when planning joint operations (JP3-13.1, 2007, Ch. 4). Considerations include: inter-service asset and joint restricted frequency list (JRFL) coordination; identification of jam control authority (JCA) requirements; EW equipment reprogramming procedures; and integration of national level assets to include computer network operations (CNO). Chapter five of the JP piles on international coordination requirements to JCEWS tasks (JP 3-13.1, 2007, Ch. 5).

A majority of the tasks focus on plans to achieve EA affects. The next concentration of tasks is on ES exploitation efforts; and finally, tasks to protect U.S. information flow. Tasks associated with information flow protection are heavily weighted to frequency deconfliction instead of full spectrum EP. Full spectrum EP includes physical hardening and security of information systems, use of frequency agile systems, and encryption of transmission. This disproportionate distribution can be explained by Libikci's (1995) observation that a large portion of EW is concerned with RADAR exploitation and jamming with the purpose of executing the suppression of enemy air defense (SEAD) mission (Ch. 5, p. 1). The key observation of the JCEWS tasks is that they are numerous and cover all aspects of EW.

JCEWS must accomplish these numerous and diverse tasks over long, medium, and short-range planning cycles. The formalized tasks are specific enough to provide guidelines, but broad enough to allow flexibility in mission accomplishment. However, individual interpretations of these tasks can result in the mission not getting accomplished appropriately. Additionally, the numerous and diverse tasks require the individual to be extremely knowledgeable on all EW subcomponents and interaction of EW systems. The impact of individual interpretations and required knowledge level is discussed further in

the people to task fit analysis. Formal structure can play a significant role in providing knowledge and guidance required by the command level EW staff to accomplish its planning and management task.

2. Formal Structure

Figure 7 is a graphical depiction of the EW command structure and coordination relationships described in the introduction8. This formal structure discussion is more in-depth and is separated into four sections: structural divisions; formal relationships; "as-required" organizations; and required training and rewards. JP 3-13.1 Electronic Warfare, Chapter IV and personal communication with Lyn Berg from the Joint Electronic Warfare Center (JEWC) at Lackland Air Force Base, Texas are the primary sources for this formal structure discussion

a. Structural Divisions

Formal structure of the command level EW organization is a hybrid of machine and professional bureaucracy. The organization is separated into divisions and uses traditional command and control and highly formalized tasks to execute its mission (United States Congress, 1986). Divisions of the organization are separated in the following order: service, bureaucratic command responsibility, geography, and then tasks. The following example is provided to demonstrate the divisions. Individuals are initially divided when they join a particular service. As a service member, they are assigned to a bureaucratic organization in a particular geographic region.

[8] Figure 7 is a copy of Figure 1. It has been repeated for ease of reference.

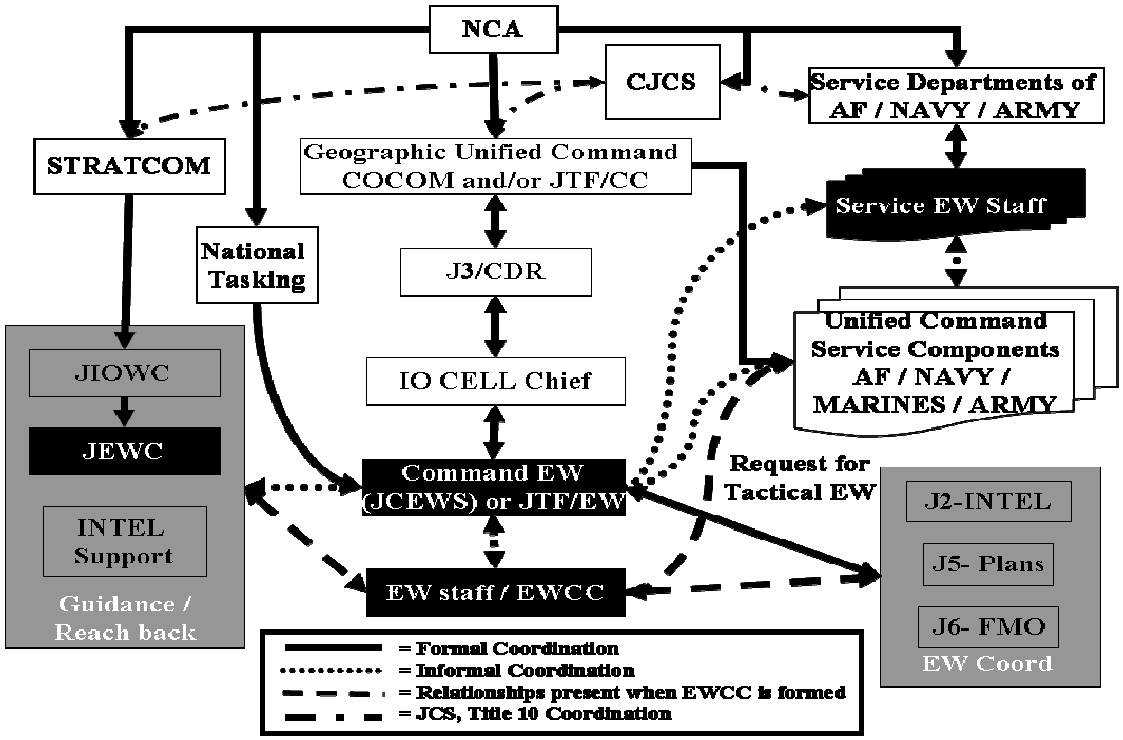

Figure 7. Joint Structure of the Command Level Electronic Warfare Organization (Derived from Joint Publication 3-13.1 Electronic Warfare, 2007)

The organization can be joint or service exclusive. Finally, the individual is assigned a particular job in the office with designated tasks. EW associated job tasks can be all inclusive or further divided into tasks based on ES, EA, or EP specialties. Since the organization is highly formalized, the basic tasks and reporting responsibilities are the same in the different geographic regions. Therefore structure and tasks of European region JCEWS is very similar to Pacific region JCEWS.

b. Formal Relationships

The apex of the command EW organization's formal structure is the National Command Authority (NCA), which consist of the U.S. President and Secretary of Defense (SECDEF). The SECDEF is responsible for the Department of Defense (DoD) that is subdivided into various agencies. This analysis is focused on the agencies that impact the planning and management of EW. The primary DoD organizations

associated with EW are the office of the Joint Chiefs of Staff (JCS); Army, Navy and Air Force military service branches; and U.S. Strategic Command (STRATCOM) (See Figure 7).

Two administrative points must be made on this structure. First, the Marine Corps and Coast Guard are administratively separate service departments. The Marine Corps is part of the U.S. Navy, while the Coast Guard is assigned to the Department of Transportation. Therefore, the Marine Corp is included in this DoD structure analysis, but the Coast Guard is not. It is acknowledged Coast Guard EW capabilities play a significant role in Homeland defense, but it is not a DoD organization. The second point is the DoD structure associated with EW is divided into three areas: functional commands of which STRATCOM is responsible for EW; geographic combatant commands (COCOMs); and service branch departments. The three separate tiers in Figure 7 depict this division. STRATCOM, COCOMs, and the service branches each contain EW offices within their structure. STRATCOM and the COCOM's EW office falls under the Information operations (IO) Cell, while the service branch departments have drastically different locations for the EW staff (JP 3-13.1, 2007, p. 8-11). The coordination between the separate DoD divisions is not mandated and can result in a stove-piping of information if not managed correctly. Each of these divisions play a significant role in EW.

STRATCOMs mission is to execute "strategic operations" and "synchronize DoD kinetic and non-kinetic combat effects" (U.S. Strategic Command, 2007). The JEWC is the division of STRATCOM responsible for EW planning and synchronization. JCEWS is the pivotal command level EW organization in the DoD structure because they are link between the tactical executors and senior staff with authority to provide resources for current and projected EW requirements. Internally, the JCEWS must climb four bureaucratic steps to inform the COCOMs of EW problems and requirements. Externally, a spider web of informal relationship must be traversed by JCEWS to accomplish their tasks.

As a U.S. based, title X empowered joint organization, the JEWC has the potential to be an effective center node for the EW community's network of agencies. It

is the largest, permanent manned organization with internal expertise in all aspects of EW and the technology to coordinate with all geographically separated EW components. Additionally, the O6 (Captain / Colonel) JEWC commander is the highest ranked joint staff position with the sole responsibility of planning and management of EW. Currently, the JEWC consists of approximately fifty-one military and civilian personnel with EW expertise[9] (Berg, 2007). The JEWCs primary role is reach back support to the COCOM EW staff and, to lesser extent, EW training for the war fighters. JEWC relationships with the COCOM and service branch EW organizations are informal. COCOM EW organizations are the most effected by this informality.

The geographic COCOMs are responsible for strategic long-term, short-term, and crisis planning. Additionally they manage personel and equipment to ensure tactical operations are effective. Internally COCOMs staffs are numbered and divided into functional mission tasking. COCOM staffs that coordinate or impact EW are J1, which is responsible for personnel; J2- Intelligence; J3- Operations; J5-Plans; and J6-Frequency Management Office (FMO). The COCOM Joint Command EW staff (JCEWS) is the primary staff responsible for planning and managing EW operations. Normally, the JCEWS consists of one to three individuals trained in only EW subcomponent mission. JCEWS are assigned to the IO Cell within the J3-Operations staff, where short and medium range planning is executed. Long range EW planning is coordinated the J5-Plans staff. EW support, attack, and protect responsibilities are divided in the COCOM structure into different functional agencies.

ES exploitation efforts are dual tasked by national agencies and the J2-Intelligence. J3-Operations execute the tactical mission, while J2-Intelligence and national agencies process the information for strategic, operational, and tactical planning. EA is coordinated within J3-Operations between the IO and Effects cells. EA is also deconflicted with J5-Plans and J6 FMO. EP is divided across multiple agencies, but not

[9] The JEWC was established in 1980 by the Secretary of Defense and reported directly to the JCS. In 1994, reporting changed to the U.S. Atlantic command. By 2006, the JEWC became bureaucratically layered under the Joint IO Warfare Command (JIOWC) and STRATCOM. Another interesting historical note that substantiates the chronological division in 1991 is that in the late 1980s, the JEWC consisted of approximately 170 personnel. This has decreased since the end of the Gulf War to the present number of 51 (Lyn Berg, 2007).

managed by one. J6-FMO manages the spectrum to prevent electronic fratricide; force protection agencies harden systems and equipment; Computer Network Operations (CNO) branch of J3-Operations defends the network; and various support agencies accomplish EP related reprogramming efforts (See Appendix D for JCEWS Tasking). Implications of this divided structure are discussed in the analysis.

Another COCOM office related to EW is each military branch service department will have at least one EW officer assigned for service specific coordination. Again, this office will normally have expertise limited to their individual service experience and in only one EW subcomponent. The COCOM service branch EW is different from the departmental service EW.

Departmental services are organized to manage EW systems and not EW missions because their job is to provide trained warriors to execute COCOM missions. Composition and organization of service department EW staffs is currently in transition. The Air Force is standing-up cyber command and transitioning from separate EW officers (EWO) to a combined navigator and EWO trained individual now labeled a Combat Systems Officers (CSO). The Army is re-establishing EW as a military occupational specialty (MOS); and the NAVY is downsizing the Electronic Counter Measures Officer (ECMO) in preparation for the EF-18G. The EW related enlisted specialties for all of the service departments are spread throughout the services similar to the divisional relationships explained in the COCOM section. Departmental service officer and enlisted EW specialties are tied to EW systems. COCOMs select individual service EW systems like an ala carte menu. Service department EW organizations main responsibility is to manage these individual EW systems, which can be challenging in the existing DoD structure.

The relationship between the JEWC, JCEWS, and service department EW organizations is informal and confusing. This confusion is increased when “as-required” EW organizations are established.

c. 'As-required' Organizations

The NCA has the authority to stand up a Joint Task Force (JTF). JTFs are established to accomplish a specific mission over a short duration in time. Appointed JTF commanders will normally report directly to the JCS and coordinates parallel to the geographic COCOM staff. Composition of the JTF is at the discretion of the appointed commander, but will frequently include an EW office. The COCOM EW staff may simultaneously fill the JTF and COCOM staff position. If a separate JTF EW office is created, the command structure within the JTF is roughly equivalent to the COCOM structure. The equivalent structure and parallel relationships is the reason JTF and COCOM staffs are combined in Figure 7. Parallel relations create confusion when EW must be prioritized for tasking and assignment. The JTF staff will be the supported staff and have primacy over COCOM, unless otherwise directed, when this "as-required" organization is established.

Another "as-required" organization identified in JP 3-13.1, *Electronic Warfare* is the EWCC. When JCEWS recognize a contingency requires a more robust EW staff they

> may request that the JFC standup a joint EWCC [Electronic Warfare Coordination Cell]. The designated joint EWCC would request additional augmentation from other JFC components to form a representative and responsive EW planning and execution organization. (JP 3-13.1, 2007, p. IV-1.

Figure 7 depicts the structural relationships when an EWCC is established. Establishing an EWCC is both bad and good. Bad, because it adds another formal bureaucratic layer and it creates more informal coordination between agencies, which can be confusing. Establishing an EWCC is good because the EWCC gives the JCEWS a more robust and specialized staff, flexibility to manage EW tasks. Effectiveness of these "as-required" organizations is impacted by training of the individuals.

d. Required Training and Rewards

The formal structure required training and rewards associated with command level EW organizations are ambiguous. Required training to fill one of the

staff positions in a command level EW organization is associated with the unit or joint manning document (UMD/JMD). The UMD/JMD identifies specific service occupational specialty codes and rank to fill the staff positions. Some UMD/JMD positions also mandate training and experience requirements. Individuals are initially assigned military occupational specialty codes after successfully accomplishing professional service branch required training in a specific EW subcomponent mission. Individual training and not the specialty codes mark the distinction between the personnel experienced in the three EW subcomponents. An example is the Air Force has a specialty code for Electronic Warfare Officers; however, these officers receive training to specialize in the EA or the ES mission (Berg, 2007). Individuals learn some aspects of the other EW components, but their primary expertise is in one. Additional training in other EW missions and components is not mandatory.

As mentioned above, the UMD/JMD designates a particular rank for each command level EW organizational key staff positions. The JEWC is commanded by a service rank equivalent of an O6 (See Table 2 for U.S. military officer service branch rank equivalent chart). A majority of the JCEWS, departmental service staff EW offices, and any EWCCs established are commanded by O5 rank equivalents, while JTFs are led by O4, or sometimes O3 rank equivalents.

Officer Rank Equivalent (OXX)	U.S. Service Branch Designator	
	Army / Air Force / Marines	Navy
O10	General	Admiral
O9	Lieutenant General	Vice Admiral
O8	Major General	Rear Admiral Upper Half
O7	Brigadier General	Rear Admiral Lower Half
O6	Colonel	Captain
O5	Lt Colonel	Commander
O4	Major	Lieutenant Commander
O3	Captain	Lieutenant
O2	1st Lieutenant	Lieutenant- Junior Grade
O1	2nd Lieutenant	Ensign

Table 2. U.S. Military Officer Service Branch Rank Equivalent Chart

The command level EW rank structure creates a rank inequality when trying to promote EW requirements to senior staff. Promotion of EW to senior staff is a necessity for effective long term EW planning and management. This inequality is discussed later in the analysis section. Promotion is also impacted by the military structure of the reward system.

Rewards associated with command level EW structure in this discussion involve the acquisition of systems and the military promotion and assignment system. Increased money allotment for EW programs is the ultimate reward in the bureaucratic system. EW organizations are tied to the bureaucratic budget process, which is extremely centralized. Tactically decentralized EW requirements are requested through the three bureaucratic tiers of the DoD structure. Command level EW organizations must justify programs and requirements in the fiercely competitive, yearly, budget cycle. Programs that achieve success or demonstrate sever deficiencies are rewarded with money. Since the service branches maintain individual EW systems, inter-service rivalries over money make yearly and long term budgets a vicious process tainted with biased information[10]. However, the budget cycle is a necessary requirement in a large bureaucratic structure. This process makes the U.S. vulnerable because they must make trade-offs between cost and capabilities. Fourth generation adversary's exploit this vulnerability because they operate independent of budgeting constraints.

The final formal structure component to discuss is narrowly focused portion of the military promotion and assignment system related to EW. The U.S. military and assignment system is developed on career broadening principles. Promotion eligibility is dependent on the accomplishment of Professional Military Education (PME) commensurate with rank. PME objectives are to provide military members with a broad knowledge of service specific history, organizational relationships, and operational planning and budgeting cycles. Promotion is based on successful completion of PME and demonstrating career progression. The military culture for progression requires individuals to be moved approximately every three years. Each physical move is called a

[10] For more information on the budgeting process reference retrieved October 25, 2007 retrieved from http://www.defenselink.mil/comptroller/icenter/budget/budgphase.htm.

Permanent Change of Station (PCS). During each three-year assignment, individuals that perform well are moved into positions with more responsibility. After ten to twelve years of service, individuals are normally PCS'd from tactical jobs to command level assignments. Service branch assignment staffs fill command positions based on the 'best available' people pool and not the best qualified. Unlike the corporate world where a company boss may hire whatever candidate they want, the government uses a third party (i.e. the assignment staff) to assign individuals to fill positions (Schirmer, Thie, Harrell, & Tseng, 2006). Military assignment personnel are restricted to selecting individuals designated as 'eligible to move' instead of the best qualified. The expertise and continuity of individuals assigned to staff fluctuates because of forced frequent moves and "best available" assignment process. Command level EW organizational success is directly related to a person's individual ability and motivation.

3. People

Joint publications do not specifically identify type and level of expertise required to effectively manage and plan EW operations at the command level. These specifics are found in the JMD and individual service manpower documents. Chapter II of JP 3-13.1 *Electronic Warfare* (2007) identifies the bureaucratic structures of EW. It also subtlety implies EW staff personnel should be trained and experienced in airborne EW. EW staff mandatory training requirements are limited, not standardized across service branches, and do not ensure education in all three EW subcomponents. The result of EW training not being mandatory, standardized, and comprehensive is 'best available' individuals meeting the rank requirements can fill key staff positions following a two week basic EW course. Rick Atkinson's (2007) Washington Post article "If you do not go after the Network, You're Never Going to Stop these guys. Never!" illustrates this point: in 2006, the "Navy sent submariner, engineers, aviators, etcetera, through a two week EW course at Whidbey Island to assist in C-RCIED efforts." Even though these individuals had an immediate impact, it is not along term solution for EW issues. Atkinson (2007) equated the EW related C-RCIED problems in Iraq to "short comings in EW expertise, especially

in Marines and Army."[11] Limited EW expertise is not limited to the Marines and Army. The Navy's two-week EW program is a band-aid solution for the limited number of qualified military EW specialists. A two-week course cannot educate individuals enough to understand all tasks required to effectively manage, plan, and employ EW.

Excluding the band-aid EW positions, the average person filling a command level Joint EW positions has a primary level EW education and an average of ten years tactical experience. Primary level EW education is defined as the service specific initial occupation qualification schools. This primary level of education provides an introductory level of information on the three subcomponents of EW; integration of EW systems; individual service capabilities; and minimal exposure to the latest technology. The result of ten years of tactical experience without graduate level or continuing education is cognitive biases towards the individuals EW specialty training. Acquiring advanced level or graduate level EW training required to effectively manage and plan EW, is left to individual intrinsic motivation (Berg, 2007).

A second order effect of the technological evolution discussed earlier is the exposure of the mass populace to new information technology. Generations that have grown up during the evolution have a greater level of knowledge, understanding, and implications of information technology. Additionally, exposure has decreased the overall fear of people to use and understand new technologies. Over the last few years, information technological experienced generations are starting to be assigned to command EW organizations middle and senior management levels. The generation running the command level EW senior staff grew up prior to the integration of computers and cell phones into everyday life. The unfamiliarity of senior staff with these systems can lead to hesitant use and fear of change. Generational differences on command staffs

[11] The author disagrees with Atkinson's assessment that about the Marines EW short comings based on personal experience and understanding of the formalized structure of the Marine Air Ground Task Force (MAGTAF). The MAGTAF has a permanent EW cell fully integrated into operations. It is the author's assessment that the Marines are the most advanced in integrating EW into tactical situations as well as planning and managing EW operations within regional conflicts. Atkinson incorrectly generalized the problems in training the average Marine on using the new C-RCIED equipment into all EW. This confusion is a result of limited education and understanding of military EW because of the secrecy of EW and its capabilities.

create tension and an internal hostile environment. Slowly this hostility is waning as technology is mainstreamed and generational shifts occur in senior leadership positions.

The benefit of mainstream exposure to information technology is an increase in the general population's knowledge level of basic EME principles. However, this increase does not equate to formal graduate level EW training. New technologies and applications of these technologies that impact EW continue to modify rapidly. Adversaries take advantage of the rapid modifications as seen in the Iraq, where the insurgents modify RCIED techniques approximately every two to six months (Pengelley, 2005). Mandatory formalized continued education is required to keep pace with the information and changes. Increased information technology general knowledge does improve management and planning of EW. Command level EW organizations use the new technology to expedite coordination and accomplish the tasks. Technology is the last component of the transformation core.

4. Technology

Technology in the transformational core is not the actual widgets used to execute tactical EW missions. Instead, it is the technology used to coordinate the management and planning of EW by command level EW organizations. Joint publications or regulations do not designate specific use of technology systems to execute tasks. Command level EW tasks include a multitude of coordination items identified in Chapter IV of JP 3-13.1 *Electronic Warfare* (2007). These coordination efforts require communication across offices, agencies, services, countries and continents. Classification restrictions and sensitivity of information require the coordination to occur via secured and unsecured channels. The elevated technological knowledge base of command level EW personnel facilitates use of a wide variety of information technology to accomplish the mission. Technology used to coordinate, plan, and manage EW includes: traditional postal and express mail; phones calls, conferences, internet, electronic mail, electronic chat rooms, websites, and video-teleconferencing. Additionally, management and tracking of physical systems, capabilities, and information is accomplished both manually and through computers. The integration of electronic and

traditional human processes has created an extensive network of information and support. This has been especially beneficial to provide tactical operator's direct access or "reach back" to home station experts on EW. Effective use of the technology to plan and manage has impacted the culture of command level EW organizations.

D. CULTURE

Culture is not a main component of the combined open systems model, but it does play a significant role within the organization. Unlike most aspects of the DoD, the organizations culture is not written down in publications or specified in regulations. Culture is created by actions taken to follow the regulations or execute the mission. Some aspects of the culture in which command level EW organizations operate have already been discussed. These aspects include the relatively small and exclusive EW community with classified restricted access, inter-service rivalries, and the predominance of an air centric technology focus when planning and managing EW systems. This culture section focuses on the DoD organization as a whole and its adversity to change.

In 1947, Congress passed the National Security Act. The act established the National Security Council (NSC), developed the Department of Defense to include the Joint Chiefs of Staff organizational structure, and established the U.S. Air Force as the third service branch (United States Congress, 1947). The intentions of this act were to establish a streamlined force that would be responsive to future U.S. military and minimize incompatibility issues and internal service self-interest struggles. The intentions were admirable, but the execution was poo. Divided loyalties, distrust between agencies, and heavy a Navy influence within the JCS, left the JCS as a weak office compared to the powerful individual services branches (Zegart, 1999, pp. 109, 127, 149). Over the next forty years, the inter-service rivalry and weak JCS led to 'status-quo' dominated culture. Service branches guarded information and kept projects classified to make sure they would never lose money or level of importance. They entrenched themselves along system projects and budget lines creating a hostile environment. Service equipment became distinct and incompatible. The DoD culture was scarred by a fear of change and reflected a stagnant strategic organization. Ultimately these culture

created issues contributed to the failed rescue of the Iranian Hostages and Grenada operations in the early eighties (Parlier, 1989). The U.S. Congress tried to correct the problems of inter-service rivalries, equipment incompatibility, and weak JCS with the Goldwater-Nichols Act (GNA) of 1986; however, the cultural aversion to change preserved (Parlier, 1989).

DoD's entrenchment culture and aversion to change is explained by Les Aspin. In 1975 Les Aspin, the future secretary of defense and initiator of the 1994 DoD spending "bottoms-up review" said "when it comes to national security matters, there is a tendency to 'play it safe.' Playing it safe usually means buying more" (Zegart, 1999, p. 159). Buying more does not equal success or progress. Command level EW organizations struggle against this aversion to change culture and the culture created by the air-centric dominated strategy. The structure is designed to purchase lots of technological based advanced systems; however these systems attack, exploit or protect against legacy EW systems and threats. Though there are many efforts DoD wide to identify future EW threats and counters, the bulk of the planning and management of EW systems remain air centric focused.

A possible explanation for stagnant culture is the generational differences between the senior staff and the rest of the EW staff. Generations less familiar with implications of new technology on EW efforts may promote the historic air-centric strategy. In effect, they influence budget and system acquisition efforts to areas where they feel comfortable because of cognitive biases. An example of the cultural impact of generational differences is the highly publicized acquisition of the EA-18 Growler (Gershanoff, 2002). The Growler will replace the EA-6B as the only dedicated EA escort capable aircraft. It will be effective in its national security mission of nation state air defense suppression; however, it does not help much in the fourth generation conflicts the U.S. has been predominately conducting since 1991. Efforts to manage and plan EW systems to counter communication COTS technology used extensively by fourth generation warfare adversaries are marginalized in the bureaucratic system until lives are lost. Recently, the air centric strategy and U.S. military culture of "play it safe by buying more" was exposed by the counter RCIED efforts in OIF/OEF. The combination of

minimal understating of EW principles and poor management of systems to counter COTS technology in an urban environment resulted in the DoD flooding soldiers with various types and quantities of EW systems. Many feel the C-RCIED systems have created almost as many, if not more problems then they solved (Fulghum, 2005 and Pitts, April 24, 2007).

DoD's cultural aversion to change, inter-service rivalries, and stagnant air centric strategy impacts EW planning and management by command level EW organizations. This has led to a growing gap between U.S. military EW requirements and capabilities. This analysis will now investigate the congruence between the transformational core components to identify why this culture perseveres and the gap continues to increase in the twenty first century.

E. CONTEXT SUMMARY

Placing the command level EW discipline into the context of the combined open systems model has been extensive because outside influences and tactical level execution affect EW planning and management. These factors had to be addressed in-depth to better understand the following fit analysis.

IV. JOINT ELECTRONIC WARFARE ORGANIZATIONAL ANALYSIS

> True genius resides in the capacity for evaluation of uncertain, hazardous, and conflicting information.
>
> - Sir Winston Churchill

A. SETTING THE ANALYSIS STAGE

This chapter begins with a short discussion on indicators an organization should consider restructuring and identifies some characteristics of troubled organizations. The frequency of these indicators and characteristics revealed in the analysis are used to determine if restructuring is required. Following this discussion is the analysis. The analysis is divided into three sections. The first section is the combined open systems model fit assessment. The second section provides the results from Burton and Obel's (1998) ORGCON analysis for two periods in history. The third section combines results of both analytical methods. Implications of these collective results are discussed in the final chapter.

Organizational consultants Bolman and Deal identify pressures that lead an organization to consider restructuring. These pressures are environmental shifts, technology changes, organizational growth, and leadership changes (Bolman & Deal, 2003, p. 84-85). A determination is made on the need for restructuring based on the presence of these pressures and an assessment of the organization's state. The state of an organization can be successful or troubled.

Bolman and Deal (2003) provide descriptions of configurations of troubled firms that were originally identified by Miller and Friesen. Two of their configurations "stagnant bureaucracies" and "headless giants" are predominant in the analysis. A stagnant bureaucracy is characterized as an "older, tradition dominated organization with an obsolete product line and top management [that] is slavishly committed to old ways" (Bolman & Deal, 2003, p. 84). A headless giant is described as "a loosely coupled, divisional organization that has turned into a feudal barony with a weak administrative

core making reactive or crisis-oriented decisions; while initiative and power resides in autonomous divisions, that compete for resources" (Bolman & Deal, 2003, p. 84-85). Organizations that do not demonstrate characteristics of a troubled state are considered successful. The presence of these indicators and characteristics exposed by the following fit analysis suggest the organization should consider restructuring.

B. COMBINED OPEN SYSTEMS MODEL BASED FIT ANALYSIS

The combined open systems model fit analysis of command level EW organizations is used to assess the relationships between the four transformation core components. Contextual information from Chapter III is used to conduct the fit assessment. Table 3 is a fit-issue assessment chart that summarizes the results of the present study. The discussion follows the order of this chart.

Fit	The Issues
Task - Organization	Unrealistic output goal, Lack of understanding of EW, Multiple broad based task for small staff, fractionalized and divisionalized structure, lack of internal authority and formal command structure to impact task, inter- service rivalry, and stove-piped resources
Task - People	Task broad, people trained generally in one subcomponent only, intrinsic motivation for knowledge, rotating assignments interrupts continuity and expertise, overall output goal is unrealistic
Task - Technology	Communication technology suitable, Adequate secure/unsecured mediums, difficulty in projecting technology to forward deployed locations, marginal at integrating disruptive technology
Organization - People	"Best Fit vs. Best Available" assignment process, 3-4 yr Rotating Assignments, limited rank authority, fractionalized structure, mandatory education minimal, individual expertise in one area of entire EW discipline
Organization - Technology	Communication technology leads to networks, informal organizations, de-centralization occurs (result is repeat tasks, lack of command feedback, and confusing/weak formal command structure can not adjust to input changes)
People - Technology	Lower staff better trained than boss, elevated general knowledge, but lack training for specific use and potential counter uses

Table 3. Command Level EW Organizations "Fit-Issue" Assessment Chart (Adapted from Nadler and Tushman, 1998, p. 9)

1. Task – Organization

Fit issues between the task and formal organizational structure expose the characteristics of a stagnant bureaucracy and headless giant. Stagnation is first seen with the persistent assignment of the counter-productive strategic task of EME control. Changes to this task are discussed further in the final chapter; however, this faulty strategic task affects the multitude of tasks assigned to formal command level EW organizations.

If one were to summarize the ten plus pages of tasks assigned to command level EW organizations into one sentence, it would be "Planning and management of U.S. military EW programs and personnel to effectively control the electromagnetic spectrum in a dynamic environment." Command level EW organizations must manipulate the DoD bureaucratic system to ensure that tactical level operators have the resources they need to execute operations. A majority of the responsibilities for these tasks are assigned to the COCOM JCEWS. The tasks are based on the air-centric, SEAD focused, technology-driven, third generation of warfare strategy discussed earlier. The JCEWS is the pivotal, bureaucratic organization between tactical operators and senior staff. DoD's hybrid professional-machine bureaucracy has significantly impeded the ability of command level EW organizations to execute their tasks in a dynamic environment.

The DoD structure in Figure 7 separates the key components of command level EW organizations into three tiers. The JEWC controlled by STRACOM is one tier. The geographic COCOM JCEWs are a second tier, and the individual service branch EW staffs are the third tier. These EW organizations are assigned to separate chains of command. When established, JTF EW positions usually are separate from COCOM EW staff. EW authority is divided between the individual service branches, JCEWS's, and the JEWC tiers. Relationships between these segregated organizations are informal and subject to changes in expertise when people rotate through assignments. The few formal relationships that do exist are impeded by bureaucratic layering and inter service rivalries that restrict the organizations adaptability.

Amy Zegart (1999) claims that the horizontal and vertical segregation of organizations, revealed in Figure 7, was purposely built into the DoD structure to "ensure each service has equal play and it [the divisions] provides money for legislatures because a decentralized, inefficient military meant more defense spending" (p. 154). Command level EW organizations are externally divided along geographic boundaries and bureaucratic responsibilities. Internally, they also are divided into the EW sub-missions of ES, EA, and EP. The multiple divisions have resulted in a structure with restricted relationships and repetitive capabilities. Minimal formal connections between divided components impede organizational coordination and adaptability. Congressional opposition to military centralization exists because multiple divisions and repetitive capabilities of the military weaken the authority of military leadership and spreads project money across congressional districts. Arizona Senator Barry Goldwater, during coordination for the 1986 Goldwater-Nichol's Act (GNA) adds, "historically, Congress has been a foe of centralized leadership of the military branches" (Zegart, 1999, p. 155).

Designing the organization with a segregated structure and redundant processes leads to resource competition. This competition fosters an internal hostile environment that creates a stove-piped functional culture. This stove-piped structure contradicts the recommendations made by DoD advisor, Dr. John Arquilla. Arquilla (2001) argues that an integrated coordination and communication network structure is required for success in twenty-first century military operations (Arquilla, Ronfeldt, United States, Dept. of Defense, & Office of the Secretary of Defense). Many of these operations are identified as conflicts and not declared wars.

Except for Allied Force in 1998 and the first stage of the Gulf War in 2003, operations involving the U.S. military following the 1991 Gulf War were considered conflicts and not wars (U.S. House of Representatives, Committee on Foreign Affairs, 2007). Since the 1986 GNA, operations declared as wars have achieved tactical success because they exceeded the bureaucratic noise threshold. The noise threshold is the combined goals and tasks executed by bureucracies on a regular basis. Conflicts have not experienced the same level of success. Because bureaucracies are inundated with issues and internal agendas, military "conflicts do not take automatic primacy over other goals

pursued by factions within the government" (Mack, 1975, p. 184). Command level EW organizations struggle to elevate primacy of tasks above the noise threshold in operations identified as conflicts.

JCEWS are buried under three bureaucratic levels within COCOM staffs. They also do not have a robust organic EW capability. Formalized requirements restrict direct access to other EW organizations and force JCEWS to take laborious steps to request EW assistance. The lack of direct formal coordination and the fact that EW authority is divided has resulted in weakened staff positions and the stove-piping of resources, which are characteristic of a headless giant. The effect of the combination of conflicts operating below the bureaucratic noise threshold and the headless giant phenomenon is illustrated by the U.S. led efforts to counter terrorist use of RCIED's. Initial efforts were divided between Army, Navy, and Marine Corps. Complications with mission execution did not break the noise threshold until many lives were lost. A Pentagon official, commenting on the EW issues with the CRCIED campaign, exclaimed, "no one realized how much tougher jamming was going to be in the ground plane" (Atkinson, 2007). The real problem is not a lack of understanding of jamming in the ground plane, but the lack of a sufficient structure to give the experts an authoritative, centralized voice.

Another task-organization fit issue is seen in the manning of command level EW positions and the affect on task coordination. JP 3-13.1, *Electronic Warfare,* Chapter II, "Organizing for Joint Electronic Warfare" is riddled with the terms "may" and "should" when describing command relationships and establishing "as-required" organizations (p. II-2). Creation of these ad-hoc "as-required" organizations increases the number of informal relationships, which affect coordination. Additionally, the lack of standardization for permanent EW organizations affects coordination. Manning levels and composition of personnel at the JEWC, COCOM JCEWS's, and service branch EW staffs are not standardized. In fact, the configuration of the JCEWS is at the discretion of the commander. This means the JCEWS can consist of one person, an ad-hoc team or a full staff to include an EWCC. As a single entity or a full staff, the JCEWS must divide their attention to manage ES, EA, and EP, while simultaneously coordinating EW with the J2, J3, J5, and J6 offices. JCEWS require cross agency coordination to be effective.

Coordination across agencies is handicapped because EW positions lack sufficient command authority. Even though the JCEWS and any 'as-required' JTF EWs established are the most central to EW issues, they lack the rank and associated authority (normally an O4 rank equivalent) to coordinate formally outside the EW community. EW expertise and authority that can assist with JCEWS EW issues is centralized at the JEWC (commanded by O6 rank equivalent). However, coordination is restricted because the JEWC is under a separate chain of command. Command level EW organizations responsibilities are large, but they lack the authority level to be effective in a stove-piped organizational structure. Requests for assistance and coordination are another task-formal structure misfit.

JCEWS and/or JTF EWs coordinate a majority of the requests to acquire EW capabilities because they connect the tactical operators and the senior level staff. JCEWS or JTFs have multiple avenues to coordinate requests. They can initiate requests through the COCOM or JTF general staff formal chain of command. They also can go directly to the individual service branches for assistance. A final option is to coordinate with the JEWC in an attempt to elevate the priority of the request in the joint system. Even though this coordination process provides multiple ways to circumnavigate the bureaucratic system; it is a confusing matrix that is redundant, time consuming, and subject to inter-service rivalries. DoD's acquisition process, which matches requests to requirements, contributes to task-structure fit issues.

The military acquisition process is service branch driven. The process can take up to twenty years to deliver a capability requested to counter a specific threat system (Griffard, 2002). In twenty years, a minimum of four people typically have rotated through staff positions and up to ten different modifications could have been made to that threat system[12]. In addition to the normal acquisition process being slow and maladaptive, it is also degenerate. The stagnant strategy and divided structure are the reasons for this erosion. The U.S. Navy's recent acquisition of the EA-18 Growler is a contentious program that highlights the degenerate nature of acquisition process.

[12] This is based on the normal three to four year PCS cycle for staff officers and the two-year technology update cycle discussed in Chapter III.

The Growler is the replacement for the aging EA-6B Prowler flown by both the Navy and Marine Corps. These aircraft are the U.S. military's primary RADAR jammer and only strike-escort capable EA aircraft. The Navy acquired the aircraft, but did not purchase any for the Marine Corps (Gershanoff, 2002). The Navy controls the Marine budget, which is a trump card in the DoD acquisition process. Arguably, the mission of the Marines, as a land based expeditionary task force, warrants this type of organic capability in the twenty-first century more than the Navy. The Navy does provide Marines transport to conflicts. Also Naval aircraft carriers globally project sea power; however, a majority of the conflicts since 1991 have required EW air assets to operate beyond the limits of Naval sea power projection. Currently, U.S. Marine Prowlers execute specific EA missions beyond naval sea power. In the future, their will be a void in this area. Availability and reliability of Marine assets will decline as the Navy phases the EA-6B from the inventory. The decrease in availability will fuel inter-service rivalries as agencies compete for limited EW assets.

Airborne EW is described as Low Density-High Demand (LDHD) assets because they are requested often, but have limited availability. The Navy plan to replace EA-6Bs with less EA-18s further decreases the density, but does not decrease the demand. This disparity increases inter-service rivalries. Tactically, U.S. Marines and Army troops that require EA-18 support are forced to fight over limited assets availability. Rivalries also are intensified when COCOMs request carrier based naval EW assets be re-assigned to forward deployed land bases beyond sea power projection. Historically, U.S. Navy carrier designated aircraft are rarely administratively assigned to COCOM land based units. These task-structure fit issues are also present in the rapid acquisition process.

In the rapid acquisition cycle, procurement and distribution of EW systems is accomplished through intra-service acquisition programs. This means the Army purchases equipment for the Army, the Air Force for the Air Force, etcetera. This system results in redundancy and interoperability issues. Rear Admiral Macy, commented that "part service rivalry, part delivery schedules, and partly the systems could not be made fast enough" contributed to the issues with the acquisition of Counter RCIED Electronic Warfare (CREW) systems used in OIF/OEF (Atkinson, 2007). Thirty variations and

10,000 individual pieces of equipment comprised the CREW systems that were acquired. These systems were fielded to ground forces with minimal training. The JTF EW responsible to deconflict the EW system was not initially integrated into the acquisition and fielding of the CREW systems. CREW systems deconfliction problems and interoperability failures resulted in electronic fratricide and unnecessary deaths (Atkinson, 2007). After the JTF-EW became aware of the issues, corrections were delayed because the position lacked authority to initiate changes. It took almost two years for the one-man JTF EW office within the IO cell in Iraq to convince the leadership to stand up and appropriately staff an EWCC.[13] The establishment of the EWCC and the mandate by the JTF commander to centralize and standardize the acquisition of joint CREW systems were pivotal steps employed to mitigate the EM mess created by these unmanaged systems. Incidents of electronic fratricide are likely to increase as units use discretionary funds to purchase cheaper, better electronics in a timely manner. The informal acquisition structure created by direct purchase of EW systems is counter to research describing organizations that effectively adapt to dynamic environments.

Organizational consultants Schoonhoven and Jelinek (1990), found that high technology organizations that do adjust effectively to dynamic environments use:

> clear organizational structures, frequent reorganizations, and quasi-structures that contributes significantly to long term innovative abilities. Additionally, the organizations employees understood the process for innovation and the formal chain of command relationships and how the quasi structures worked. (p. 117)

The technology used by command level EW organizations to coordinate does not make them a high technology organization; however, the high technological dynamic environment in which they operate does. A confusing, stove-piped formal command structure, segregated by inter-service rivalries, and minimized by weak authority in rank match the stagnant bureaucracy and headless giant characteristics. The fit issues between

[13] The author was deployed as an aircraft liaison working with the one man JTF-7 EW staff within the IO cell in Baghdad. JTF-7 was later designated Multi-National Corps Iraq (MNC-I) in May 2004. The efforts to stand up an EWCC began in April of 2004, but was not formally stood-up until the summer of 2005. In the spring of 2006, the EWCC at MNC-I was appropriately staffed.

the command level EW organizational structure and tasks overshadow the remainder of the combined open systems model fit analysis.

2. Task – People

EW tasks include EP efforts to protect computers and information networks, ES collection of information to be analyzed by intelligence, and EA mission's intent on denying adversaries ability to get information. Misfits between these tasks and people assigned to accomplish these tasks are a result of training, education, personnel ambitions, and to some extent access restrictions.

Training in EW tasks is not standardized internally to service branches or externally across services or EW missions. People assigned to command level EW organizations have different training requirements and experiences. The differences reflect qualification requirements for service branch programs. The resultant fit issue is that people assigned to command level EW are not trained in all the tasks.

As mentioned earlier, the unit or joint manning document (UMD/JMD) matches staff job requirements to military occupational specialty codes. Individuals earn a specialty code after service required initial training programs are completed. Individual experiences from conducting EW missions complement initial training. A large majority of the command level EW positions are coded for air trained EW positions because of the historical focus of the air-centric EW strategy.

Currently, the 563rd Flying Training Squadron, Randolph Air Force Base, Texas provide initial joint undergraduate EW training to Air Force, Navy, and Marine aviators selected to be EW officers (Global Security.org, 2005). This aviator joint undergraduate EW training appropriately covers broad EW concepts and is air-centric focused. After graduation, EW aviators attend aircraft specific training before earning their service specific military occupational specialty codes. Beyond this mandated basic EW course, the advanced training and experiences vary greatly among the service EW aviators. AF EW Officers (EWOs) trained to execute EA missions in the EC-130H Compass Call have

very different experiences than Naval Flight Officers (NFOs) trained to execute EA-6B EA missions. Additionally, EA trained EWOs are different from EWOs trained in the RC-135 ES mission.

In addition to aviators, each service has additional specialty codes that execute various EW related missions. Personnel assigned to these codes have their own training and experiences. Naval surface and subsurface, Army signal intelligence, Marine Radio Battalions, and force protection personnel all execute EW operations; however, they do not attend the Joint EW School in Texas. Conversely, the aviators do not attend the undergraduate level training for these EW related career fields. The isolated and divisional structure prevent standardized undergraduate level training. Graduate level EW training can close the gap between required EW task knowledge and individual EW knowledge.

Graduate level EW training is available; however, training is not mandated by service branches, standardized across them or accredited.[14] Attendance is subject to individual ambition and service funding (Berg, 2007). Course accreditation would ensure that command level EW required planning and management tasks are taught. Rank based Professional Military Education (PME) series is the only mandated training for military personnel. PME series focus on broad joint operational concepts, DoD planning and budget processes, military history, and service branch organizational structures. Standardized and mandated training deficiencies result in the misfit between extensive required EW task knowledge and personnel with limited EW task knowledge.

People assigned to command level EW organizations bring cognitive biases from service branch specific EW training. Cognitive biases foster task-people fit issues because people accomplish familiar tasks and tend to avoid unfamiliar tasks. On the job training (OJT) is required to compensate for EW training deficiencies and cognitive

[14] The 563rd FTS, JEWC, Joint Forces Staff College and several EW organizations like the Association of Old Crows (AOC) provide graduate level EW courses for military and DoD members. Attendance is and requires external approval and funding. Additionally, the USAF Weapons School (USAFWS), Naval EW School (NAVEWS), and Marine Corps Aviation Weapons and Tactics Squadron (MAWTS) offer graduate level EW training and joint integration employment concepts. Attendance to these courses is based on a highly competitive selection process.

biases. Three to four year PCS requirements equate to task knowledge regression as each assigned individual begins a new OJT cycle. This OJT regression cycle is more severe with tasks that involve restricted access classified programs.

Command level EW staff assigned personnel are required to plan and manage classified programs. Restricted access to classified programs naturally leads to limited program knowledge level. Each PCS results in a regression in program expertise. Some individuals avoid coordinating classified programs because security procedures are perceived to be 'too cumbersome' or they want to avoid harsh punishments associated with program security violations. In the classified or unclassified realm, command level EW assigned personnel must establish trust to be successful.

Yvonne Lederer-Antonucci, *et al.*'s (2003) business trust research revealed that, "establishing trust is the fundamental requirement for successful business to business relationships." Trust is established through job performance competency, reliability derived integrity, and empathetic benevolence. Trust based relationships are even more important when organizations that make up a team are geographically separated. Internally, task competency built trust is necessary for command level EW to overcome the three chain of command tiers and four bureaucratic layers within the DoD structure. Externally, trust gained by individual competency is required to effectively coordinate all the required EW tasks across multiple agencies that are geographically separated. A formalized, accredited graduate level training program could mitigate the task-people incongruence created by non-mandated standardized training and constant personnel PCS requirements.

3. Task – Technology

Task-technology fit issues are minimal when executing short-term tasks; however, issues are present during long term planning and management of EW. Stateside and permanent overseas DoD installations have harnessed communication technology effectively to manage and plan short term EW operations in all classified realms. Near real time coordination between geographically separated organizations is achieved through a combination of secured and unsecured land based, satellite, wireless, and hard

wired information systems. Internet chat protocols, websites, video teleconferencing, traditional phone lines, satellite and wireless connections, and personal face-to-face meetings are used to manage and plan EW. Organizations are authorized limited discretionary funds to purchase information technology (IT) systems necessary to create the network of EW organizations recommended by Arquilla (1997). Two task-technology fit issues are related to forward deployed connectivity and mass acquisition of information technology systems.

The requirement to have forward deployed EW organizations is a secondary effect of the evolution of fourth generation warfare. JTF EW staff and other command level EW organization that operate outside permanent DoD installations have fewer resources and limited IT connectivity. Availability of the full compliment of secured and unsecured IT is based on site protection. Networked links with remote organizations is restricted until physical and electronic protection requirements are met. Connectivity also is limited by mobile bandwidth restrictions. Command level EW organizations must make trade-offs between cost, security, classification, and bandwidth when establishing connectivity. Knowledge of and accessibility to the latest technology is required to mitigate trade-off loss. Recognition and individual authority to purchase IT is the second task-technology misfit.

Knowledge of IT systems is required to recognize applications to EW planning and management tasks. IT education is not mandatory and is left to the ambition of the individual. Organizations can use discretionary funds to purchase limited numbers of equipment, however mass acquisition requests compete with other mission requirements. Large corporations, like DoD, typically delay acquisition of new systems until they have been proven or deemed mission essential. Harvard Business school professor Clayton Christensen explains that hesitation is because large corporations work with sustaining technology.

> Large corporations excel at knowing their market, staying close to their customers, and having a mechanism in place to develop existing technology. Conversely, they have trouble capitalizing on the potential efficiencies, cost-savings, or new marketing opportunities created by low-margin disruptive technologies. (TechTarget, 2006)

Christensen uses real world examples to demonstrates how big corporations can dismiss the value of disruptive technologies that do not reinforce current company goals. Corporations are blindsided when technology matures, gains a larger audience, market share, and threatens the business status quo (TechTarget, 2006).

Command level EW organizations either failed to plan or did not effectively elevate long-term plans above the bureaucratic noise threshold in time to counter disruptive technology on the battlefield. The introductory examples of EW deficiencies are the result of long-term plan failures. Based on this research, we can speculate that the weak authority structure contributes to this fit issue in command level EW organizations. Hesitation to adapt to disruptive technology and failure to elevate plans above the bureaucratic noise threshold due to fragmented and weak command authority are characteristics associated with stagnant bureaucracies and headless giants. Personnel that execute command level EW tasks must have the knowledge and authority to monitor, identify, acquire, train, and employ new technologies in order to overcome task-technology fit issues.

4. Organization – People

Some misfits between formal organization structure and people have been discussed. These are a fragmented structure, a lack of graduate level, formalized education and limited expertise in only one mission of EW. All of these contribute to organization-people fit issues. Additional organization-people fit issues include the DoD assignment process and organizational rank structure.

Mentioned earlier, the DoD assignment process is based on a three to four year PCS transfer cycle. Functional managers or branch chiefs assign individuals to organizations. Managers identify individuals for assignment to command level EW staff based a pool of people available to move within the cycle. This “best-available” assignment process does not guarantee that the best-qualified person is selected. The discrepancy between individual qualifications and required tasks is not corrected by formal training. The DoD assignment cycle results in corporate knowledge and trust regression every three to four years. As command level assigned EW individuals regress

to re-establish trust and gain task knowledge, adversarial capabilities and expertise increase. This growth disparity is a potential recipe for disaster. A 2007 Defense Officer Personnel Management Act (DOPMA) review acknowledges the gravity of this incongruence: "the current military personnel management will not meet needs of future operating environment" (Schirmer *et al.*, 2006, p. iii). U.S. command level EW organizations will have trouble overcoming stagnation if they have to retrain personnel and rebuild internal relationships every three to four years. Mandated professional graduate level training is one way to minimize the OJT regression and develop consistency of personnel experiences. Consistency combined with proficiency equates to trust, which is a vital component of successful teams (Bolman & Deal, 2003, p. 105).

The combination of bureaucratic layers and weak command authority is the final organization-people misfit. The JEWC commander is the only command level EW staff positions above the O5 rank. The O5 rank is the corporate world equivalent to lower senior staff/middle management. Completion of EW staff tasks requires coordination across joint services and with multiple agencies. The lack of EW staff rank-based authority inhibits coordination and task accomplishment. Issues with EW tasks are subject to formal chain of command procedures, which delays mission accomplishment. JCEWs are first forced to compete against other core components of IO for the attention of the O6 rank equivalent IO cell chief. If this battle is won, JCEWS must then fight through the J3 operations commander and two more layers of bureaucracy before EW issues are presented to the COCOM (JP 3-13, 2006, p. IV-5). This process can be lengthy and severely degrade the accomplishment of formalized tasks in a timely manner. The fragmented structure also induces delays and degrades task accomplishment.

Command level EW organizations are divided by geography, chain of command responsibilities, and EW subcomponents. These divisions create many problems. The geographic separation makes it difficult to coordinate, plan, and manage EW. As the only O6, the JEWC commander's power to assist other command level EW personnel with EW issues is marginalized because most EW staff positions are outside the JEWC chain of command. Individual EW expertise and execution of EW sub-mission are spread throughout various joint staffs. Even though JCEWs are responsible for EW, the

J2, J6, and J3 staffs accomplish some form of ES, EA, and EP. EW related information is not reported to or coordinated with the JCEWS by these different agencies. A centralized structure with appropriate command authority is required to formulate a comprehensive command level EW picture.

Combined, the fit issues between personnel and the segregated divisional structure contributed to the difficulties encountered in OIF. The JTF EW was unable to elevate the counter RCIED issues above the bureaucratic threshold until lives were lost (Atkinson, 2007). The organization-people fit issues associated with training deficiencies, rank and authority inequalities, and fractionalized EW structure are characteristic of a headless giant and stagnant bureaucracy.

5. Organization – Technology

An increase in informal structures is the result of the fit issue between formal organization and technology. Bolman and Deal (2003) state that organizations that correctly use information technology have a "flatter, more flexible, and more decentralized structure" (p. 59). Command level EW organizations effectively use IT to develop networks and informal structures that circumnavigate bureaucratic inefficiency. Development of informal organizations does improve coordination; however, they risk fracturing the chain of command (Bolman & Deal, 2003, p. 64).

Additionally, the flexible and decentralize informal structure is outside the formal planning and acquisition process. Organizations use IT to link directly and get critical information fast, but information is shared only between two connected nodes. Command level EW organizations are bypassed or receive inaccurate information because of informal relationships. Missing or inaccurate information results in poor EW planning. EW systems acquired based on bad information will not meet task requirements. The rise of informal structures within EW counters research on organizations that effectively adapt to dynamic environments. Schoonhoven and Jelinek's (1990) identify that formal structures and quasi-formal relationships are required for organizations to adapt effectively to dynamic environments. The organization is flexible, but flexibility does not equate to adaptability.

6. People – Technology

People-technology fit in command level EW organizations is congruent. Command level EW personnel have effectively employed technology in accomplishing their tasks. Creation of websites like the JEWC reach-back site and E-Space[15], secured chat rooms, and integration of COTS information systems are important components that affect the U.S. information flow. Use of this technology has created virtual networks within the entire EW community and across the U.S. military. These networks are also known as informal organizations. Fit issues generated by informal organizations have been described. Generation differences in IT use and understanding is the only remaining potential fit issue.

This IT based "generation difference" (discussed in Chapter 3) fit issue significantly impacts long term EW plans. Senior individuals that do not understand the importance of technology cannot effectively operate within the bureaucratic program acquisition and budget process. Eventually, the widgets required to employ tactical EW are not acquired in a timely manner or, worse, not at all. Generation differences may be the reason Clayton Christensen's observed that large corporations have trouble acknowledging and adjusting to disruptive technologies (TechTarget, 2006). Failure to adapt to technologies leads to a failure to plan and manage future EW requirements.

7. Summary

The fit analysis of command level EW communities within the context of the combined open systems model exposed several fir issues. Three predominate organizational problems were identified: (1) insufficient training; (2) weak command authority; and, (3) limited formal coordination due to a divided structure. These organizational fit issues are cumulative and the second and third order effects impede the organization's ability to adapt to dynamic inputs.

[15] These websites are just two examples of many websites created to help the U.S. military to coordinate EW. These sites are accessed through secured connections.

C. ORGCON EXPERT SYSTEM DIAGNOSTIC FIT ANALYSIS

Burton and Obel's (1998) expert system Organizational Consultant (ORGCON) software was used as a secondary method to analyze the DoD organizational structure of command level EW organizations. The theory and methodology for the expert system ORGCON were discussed in Chapter II. Appendix E contains the list of ORGCON's questions, authors' responses, and ORGCON's fit analysis output with design recommendations for both periods.

Two ORGCON analyses were run to compare the structure and environment of command level EW organization as it stood at the end of the 1991 Gulf War and as it stands in 2007. Analysis is separated at the end of the 1991 Gulf War based on the four reasons discussed in Chapter III. Table 4 contains the context of two analyses, in terms of some of the structural and environmental distinctions between the two periods.

1986-1991	1991- 2007	Command Level EW Structure Considerations	
JEWC staff 170 Personnel, main focus of EW plans and management, Direct access to JCS	JEWC staff manned at 50 personnel, subset of JIOWC	JEWC	Divisional Level Manpower base
Min-manned JCEWS (usually 2-3 People),	Min-manned JCEWS (usually 1), main focus of EW plans and management	JCEWS	
Coalition Force / Limited, small scale JTFs	Multiple JTFs (Horn of Africa, OIF, OEF, Philippines)	JTFs	
EWCC concept established (Gulf War)	EWCCs used in Allied Force, OIF stage 1 (disbanded in 2003), 2 EWCCs established in OIF/OEF in 2006	EWCC Status	
Majority of staff positions filled by air-centric trained EW	Majority of staff positions filled by air-centric trained EW	Training	EW Expertise
Army EW to be phased out in early 1990s	Army EW phased out in early 1990's returns in 2007	Army EW Notes	

Table 4. Command Level EW Organizations Structural Considerations Divided In Two Periods.

As Table 4 shows, command level EW task requirements and complexity increased across the two periods, while the number of people and EW expertise decreased. Additionally, EW formal and informal organizations were established and administrative restructuring, which moved the JEWC under the IO Cell, created more bureaucratic layers. These contextual distinctions are reflected in the author's inputs to the ORGCON expert system. Table 5 presents input differences and the rationale for these differences between the periods reflective of these contextual changes. The differences show an increase in formalization and control by senior management, a requirement shift from mass production to specialized services, and multiple environmental changes.

1986-1991	1991- 2007	Rationale for Difference
41-60 % written instructions	81-100% written instructions	More formalization over time, incorporated informal organizations
61-80% top management control decisions	> 80% top management control decisions	Stronger Congressional oversight after Gulf War, Budget constraints and inter-service rivalries has increased control of decisions
Little mid manager new project control	Some mid manager new project control	Increased fractionalization and decentralization allow JTF and COCOM EW staff ability to purchase or nominate new EW requirements (e.g. JIEDDO)
Little middle manager exception discretion	Some middle manager exception discretion	More levels of middle managers with the multiple JTFs stood up in Terrorism conflicts
Standard high volume service technology	Specialized customer orientated technology	Focus changed from military targets and defeat of IADS to precise EW requirements per regional conflicts, also varies within each region
Average dominant technology	Strong dominant technology	Hybrid of commercial and military minimized RADAR focus to Wireless, computers, and short range frequency agile communications
Low environment uncertainty	High environment uncertainty	Change from 3rd Generation to 4th Generation warfare and Technological evolution (conflicts vs. Nation state wars)
Low equivocality	High equivocality	JTF structure based on single theater combat not multiple-globally spread conflicts of 4th generational warfare
High environment hostility	Extreme environment hostility	Change from 3rd Generation to 4th Generation warfare and Technological evolution (conflicts vs. Nation state wars)
Low process innovation	Medium process innovation	Average person has improved concept of technology and able to employ techniques to manage, coordinate better
Low trust	Medium trust	Success of fixing IED EW problems has increased trust (seen in Army re-establishing EW officer position)

Table 5. ORGCON Differences Inputs: Pre and Post 1991 Comparison Rationale

Table 6 summarizes the ORGCON analysis for both periods. Table 6 also provides ORGCON assessed structure misfits and the implications of these misfits on task completion. The results of the ORGCON analyses are consistent with the combined open systems model assessment that the structure of command level EW organization have failed to adapt to the dynamic environment. The following discussion explains how this statement was induced.

1986-1991	1991- 2007	ORGCON Analysis Structure Misfits and Implications
Senior Management Style		Situation misfit not good in a complex and dynamic environment, management is risk averse, top level is inundated with information which delays actions
micro-involvement	micro-involvement	
Climate		Formalized and structured work place where procedures govern what people do and hold organization together but organization is internally focused and may not see the shift or need for change, lacks innovation
Internal Process	Internal Process	
Strategy		Moves into new product after viability has been proven while pursuing some new products on their own. Should have medium level of centralization with high control over current activities and less over new ventures (Burton *et al*, 1999, p 265)
analyzer with innovator (combines defender and Prospector)	analyzer with innovator (combines defender and Prospector)	
Hostility		Extremely formalized bureaucracies can not act appropriately in a highly hostile environment
High	High	
Structure		Good fit due to diversity of products and geographic spread of organization / Conferences among technical professional can be effective
Divisional	Divisional	
Organization-Task Misfits		The increase in Organization-task misfits and presence of seven further recommendations in the post 1991 output implies the organization has not adapted to the dynamic environment and change is recommended (See Appendix E for details)
complexity and configuration	complexity, configuration, centralization, and formalization	

Table 6. ORGCON Expert System Analysis Output Describing Command Level EW Organizations (Derived from ORGCON Output, Appendix E)

Overall, ORGCON assessed two organization-task misfits and identified zero future recommendations for the command level EW organizational structure between 1986 and 1991. This assessment implies that the initial organizational structure (1986-1991) was compatible with the tasks. Conversely, ORGCON assessed the current structure (1991-2007) as having four organization-task misfits, and it generated seven future organization recommendations. The increase in misfits and recommendations

implies that the current structure in which command level EW organizations operate is not congruent with the required tasks. The results are interpreted as indicating that the organization has not adapted to the dynamic environment in the twenty-first century.

Despite the contextual changes, the ORGCON results indicate that senior management style, climate, strategy, hostility, and organizational structure were basically identical for both periods. The micro-involvement style of senior management and the strategy of analyzer with innovator creates a centralized, information saturated leader and a risk-aversion organizational culture. This management style and strategy combination is one possible explanation for the difficulties encountered by command level EW organizations trying to get EW issues prioritized above the bureaucratic noise threshold. The senior leadership is too involved in daily tasks, they are unable to develop a long term strategy. This preoccupation with daily tasks affects education and understanding of new technologies. The lack of understanding results in a reluctance to integrate new technologies into long-term plans until the technology has been proven.

Long term planning failures can be also attributed to the internal process climate created by inter-service rivalries and compartmentalized expertise. EW organizations have to constantly reinforce entrenched positions to defend programs and protect budgets. The problem is the entrenched positions are divided by stove-piped command structures. This division restricts lateral coordination, which would permit command level EW organizations to mutually defend EW interest in the budget process. Fragmented and pre-occupied with these battles, they do not recognize the symptoms associated with a need to change. The internal process climate as a result of the structure does not allow command level EW organizations the flexibility required to respond to the highly hostile environment created by the co-evolution of IT and fourth generation warfare. Combined, these individual indicators revealed a conflicting structural requirement.

ORGCON assesses the structural requirement to be centralized, yet flexible is a misfit. This misfit is created because the EW tasks require high control of and centralized accountability for EW programs and systems. At the same time, the tasks require flexibility to adapt to the changes in the dynamic environment. This is equivalent to the combined open systems model assessment that control and accountability of EW

was difficult due to a weak command authority dispersed throughout a fragmented structure. The JEWC represents a potential centralized hub to coordinate EW, but it lacks command authority to cross agencies or elevate joint EW issues above the bureaucratic noise threshold until lives are lost. Analysis also reveals the lack of standardized experiences and mandated job related professional education decreased the flexibility of organizations. Attempts to be flexible are localized to individual services and units that purchased EW and IT systems; however, system interoperability failures at the joint level have negated any advantages. The multiple misfits identified by the collective assessment of the combined open systems model and ORGCON analyses lead to a number of recommendations for organizational changes.

D. ANALYSIS SUMMARY

The collective assessment of the combined open systems model and ORGCON analyses lead to the conclusion that command level EW organizations are stagnant and have failed to adapt to the dynamic environment. It suggests the characteristics of a stagnant bureaucracy and headless giant. Stagnation is a result of limited formal coordination, weak command authority, insufficient training, and a fragmented divisional structure. These conclusions are characteristics of a troubled organization that requires change. ORGCON analyses suggests that command level EW organizations change to a centralized, but flexible structure. Restructuring to meet this requirement is difficult, but achievable. The next chapter identifies realistic restructuring recommendations that will allow the organizations to adapt effectively to the dynamic environment of the twenty first century.

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V. RECOMMENDATIONS AND CONCLUSION

> As a general rule, the most successful man in life is the man who has the best information.
>
> - Benjamin Disraeli (1800s British Statesmen)

The exploitation inadequacies prior to September 11, 2001; attack problems encountered in the C-RCIED campaign; and protection vulnerabilities exposed by Chinese hacker intrusions into DoD systems demonstrate symptoms of EW decline. This thesis combined the contingency theory based combined open systems model and Burton and Obel's (1998) ORGCON expert system to draw conclusion about the affect command level EW organizations have on the symptoms of EW decline. The collective assessment concluded that the command level EW organization is stagnant and has failed to adapt to the dynamic environment. The stagnate bureaucracy and headless giant attributes exposed by the analysis exemplify characteristics of organizations that require change (Bolman & Deal, 2003, p. 58). Michael Vickers, Director of Strategic Studies from the Center of Strategic and Budgetary Assessment, when testifying before the House Armed Forces committee, acknowledged the necessity for the U.S. to modify the composition and hierarchical structure of governmental agencies (Vickers, 2006). Reorganizing a component of a large bureaucratic institution responsible for the defense and security of the nation is a complex problem requiring an integrated solution.

The intent of the following discussion and recommendations are to ensure U.S. information flow advantage in the twenty-first century. The intent is not to trivialize the efforts of existing organizations or individuals actively engaging in efforts to improve the adaptability of command level EW organizations to dynamic environments. Changes start with a change in strategy. The strategic task of EME control is addressed prior to recommending structural changes.

Burton and Obel (1998) pose the question "does strategy follow structure or does structure follow strategy?" (p. 252). This discussion implies that strategy drives the organizations structure. The historical review and thesis assessment support Libicki's

(1995) declaration that EW is assigned an unachievable, self-defeating strategic task of EME control (Ch. 11, p. 2-3). The 2007 version of JP 3-13.1 states, "The purpose of EW is to deny the opponent an actual or perceived advantage in the EM spectrum and ensure friendly unimpeded access to the EM spectrum portion of the information environment" (p. xii). This purpose statement is a change from previous EW mission statements and is not standardized across joint publications. The perception of EME control persists with the phrases "deny opponent advantage" and "ensure unimpeded access." As more commercial information systems are developed, acquired, and integrated into the battle space, EW supremacy will remain localized and achieve only tactical implications. Libicki (1995) suggests the DoD should employ an EW strategy focused on supplying and protecting U.S. use of the EME instead of controlling through denial (Ch. 11, p. 2).

A proposed new strategy is as follows: 'the purpose of EW is to maintain U.S. information flow advantage'. Controlling implies the ability of the EW community to dominate every aspect of the EME. Conversely, maintaining implies adjustments to the dynamic environment in order to keep pace with requirements and achieve the advantage. It implies also that system, time, location, and EM spectrum trade-offs are required to accomplish the task. Strategic priorities are opposite of the current strategy. The priorities would be to first, protect information; second, exploit adversary information; and third, attack adversary information flow with precise electronic fires. Efforts to change the structure of command level EW organizations may be fruitless if the driving strategy is not appropriately modified.

A. RECOMMENDATIONS

The collective assessment of the combined open systems model and ORGCON identified command level EW organizations require centralization, yet flexibility. Currently the structure is fragmented and operates with weak authority that is buried under bureaucratic layers, and the organization lacks a formalized graduate level training program. One course of action (COA) to correct these problems is to establish a formal centralized EW structure. The JEWC would be the center coordination node of the structure that is networked to professionally educated EW nodes. The JEWC would be

the central, but not primary, agency responsible for command level planning and management of EW. The geographically separated combatant JCEWS and Joint Task Force EW positions would coordinate planning and management functions through the centralized JEWC hub. This course of action (COA) would require a total reorganization of U.S. DoD EW organizations and create chain of command authority issues that would degrade COCOM combat operations. Additionally, the reorganization would require another act of Congress comparable to the 1986 GNA. This is improbable, impractical, unrealistic and unnecessary. Instead, an alternative COA presents internal measures command level EW organizations can take to restructure for success.

Recommendations for command level EW organizations internal reorganization courses of action are based on two concepts. The first concept is Galbraith's contingency principlethat there is no one best way to structure an organization (Galbraith, 1977, p. 28). The second concept is that successful organizations use frequent reorganizations and a mix of formal and quasi-formal structures to effectively adapt to dynamic environments (Schoonhoven & Jelinek, 1990, p. 253)

U.S. military organizations that execute EW within the large DoD structure are diverse, geographically separated, and have a long, distinguished history of success (Schroer, 2003). Restructuring such an organization can seem daunting, but has precedence for success. Schoonhoven and Jelenik (1990) provide the example of XEROX. Xerox restructured following several failures in the middle nineteen eighties. Staying true to their original mission and strategy, Xerox emerged from the internal restructure as a successful company (Schoonhoven & Jelinek, 1990, p. 253). Taco Bell also restructured in the late eighties to become an international powerhouse in the fast food industry (Hallowell & Schlesinger, 1991). An interesting note to the Taco Bell case study is that the company's configuration remained primarily a machine bureaucracy. However, a change to the strategic focus combined with internal restructuring of the supply line, production procedures, and employee training significantly increased consistency, speed, quality, and profits. Inspired by these examples, the following three recommendations are made for restructuring the network of command level EW organizations to adapt effectively to the dynamic environment in the twenty-first century.

1. Command Authority and EW Recognition Equal to National Priority

'Rank has its privileges' is a popular phrase in the military because it is a fact of life. The military requires good order and discipline to be effective in its mission. Order and discipline are achieved through a formalized chain of command. Levels of respect, professional courtesies, and privileges are earned as rank is achieved and individuals progress up the chain of command. Greater responsibility and authority accompany increased rank. This authority empowers leaders to directly present requirements to senior military decision makers. The combined open systems model analysis revealed that EW organizations have difficulty elevating their concerns to senior leadership. EW priorities are not elevated above the bureaucratic noise threshold until people die or war is declared. Restructuring EW can shift the focus to actively prevent EW related problems instead of passively delaying reactions until triggered by American loss and death.

Increasing the rank-based authority of senior staff positions is the first and arguably the easiest change to the command level EW structure. In 2003, Michael Lawrence in his paper, *Organization for Information Operations in the Joint Task Force*, expressed the necessity for restructuring of the IO community as a whole. Lawrence (2003) recommended an increase in the rank of key individual positions is required if the community is to successfully plan and manage IO functions (McLaughlin, 2003). The following are recommendations to elevate the rank-based authority for leaders in key command level EW organizations. The JEWC, as the senior Joint EW organization, would be commanded by a minimum of an O7, but preferably an O8 rank equivalent. JCEWS, JTF EW staff, and service branch headquarters staff EW commanders would be an O6 rank equivalent. Even though the additional rank does not guarantee primacy of concerns, it does provide a more authoritative and direct voice to senior DoD leaders who make decisions on long-term plans. Complimenting the increased rank authority are formal structure changes to improve prioritization of EW.

The JEWC is the largest permanent military staff responsible for coordinating EW. It has the highest rank EW commander at the staff level, is a title-10 Joint

organization, and is located in the United States. Combined, these attributes equip the JEWC with potential to be an effective central node to coordinate EW plans and management. This COA recommends the JEWC is formally established as the center coordination node for Joint EW by mandating direct coordination. Mandatory direct coordination is formalized in Joint Publications. Current Joint Publications do not formalize coordination with the JEWC. The JEWC is primarily a support agency to COCOM EW operations. Administratively confined to STRATCOM, JEWC coordination by COCOM EW staffs is optional and assistance to elevate theater EW problems is minimal. Geographically displaced JCEWS, JTF EW staff, and service EW staffs coordinate with the JEWC 'as-required'. The formal mandated relationship between the JEWC and the other EW staff components is based on network architecture to avoid creation of another bureaucratic layer.

Internal JEWC restructuring is required to accommodate the increased formal relationships. Once staffed appropriately, the JEWC would be divided into regional reporting focus areas to establish continuity and expertise. Regional EW issues and actions will continue to operate within COCOM staff chain of command, but will provide parallel coordination with the JEWC. This formal parallel relationship provides the JEWC leadership with situational awareness of global EW issues. JEWC regional reporting areas would meet frequently to create a fusion point for geographically displaced EW staffs. This formalized fusion point can then monitor for trends consistent across regions as well as identify regional EW hotspots that require joint level attention.

Parallel-networked structures provide a formal alternative for EW staff to overcome regional bureaucracy. EW Issues not prioritized appropriately in theater can be brought up through Joint channels with the authority of the JEWC commander. Simultaneously, the JEWC will consolidate EW related information to develop a centralized GOOGLE-like capability for military EW. Information initially lost through direct informal relationships will be included through mandatory coordination. This formalized JEWC structure discussed above and illustrated in Figure 8, will improve the process used to share EW information across agencies and continents.

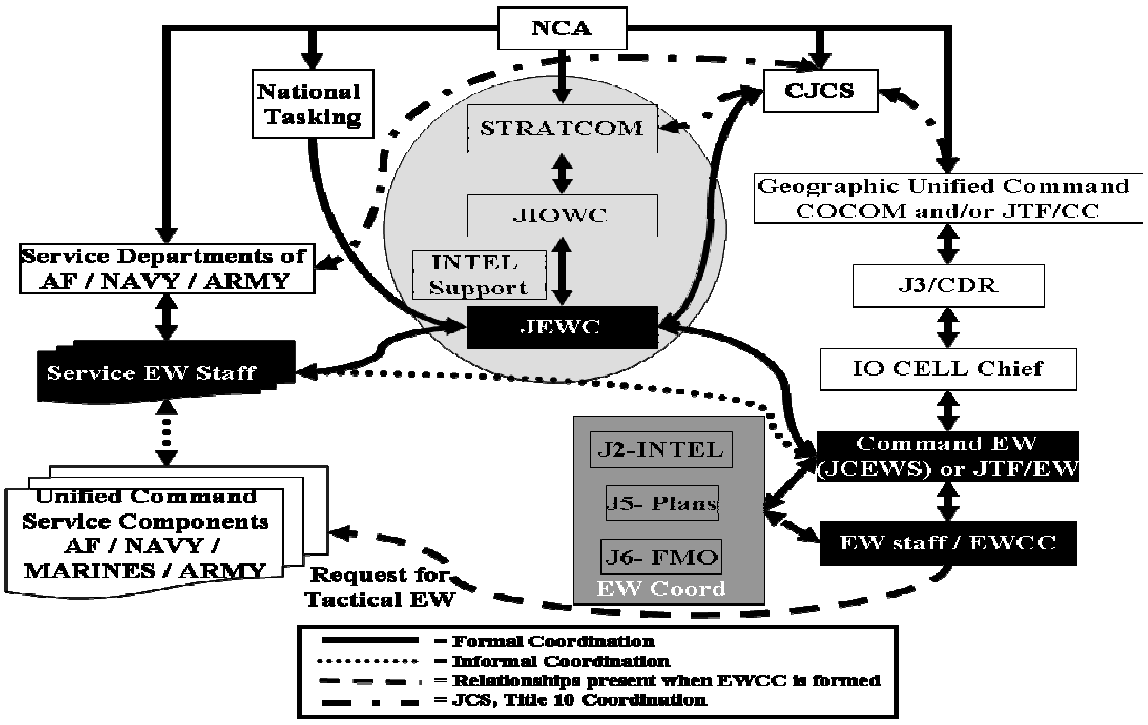


Figure 8. Recommended Command Level EW Structure and Relationships.

Staffing of the restructured JEWC must take a higher priority in the military assignment process in order to establish the basis for the new structure and ensure success. The regional reporting divisions must include air, ground, sea, space, and cyber trained EW experts that understand principle electronic protect, exploit, and attack capabilities and implications. If the JEWC is not initially manned correctly, the formal coordination structure will fail because the regional command level EW staffs will not get the service they require or expect. If the JEWC fusion center does fail, the growth of informal organizations and relationships will again dominate and fractionalize the organization.

Another formal structure recommendation is to mandate that the COCOM JCEWS and JTF EW staff be manned appropriately with a compliment of EW trained Joint personnel. Staff complement is similar to the JEWC but is not as robust. This compliment should balance joint EW expertise with regional requirements. The staff should be permanent and commanded by an O6 rank equivalent. A balanced compliment of Joint EW expertise will provide commanders improved staff and requirement

recommendations to establish EWCCs. The multiple pages of tasks formalized by Joint publications can be distributed throughout the permanent staff. Fully staffed JCEWS commanded by an O6 rank equivalent can improve EW management and protection efforts by forcing tactical units to report equipment using the EME. The merger of power COTS information systems into military application eliminates the possibility that individual units will be isolated electronically (Kerr & McCarthy, 2000). JCEWS must be knowledgeable on systems using the EM spectrum within an operating area if they are to deconflict EW systems and avoid the electronic mess experienced in Iraq (Atkinson, 2007).

The final recommendation is for senior officer to address the obvious disparity between U.S. government statements and actions. Even though the 2006 National Security strategy calls for the "unblinking eye" and recognizes the importance of information flow on national security (National Security Council, 2006, p. 47, 55), the DoD continues to downsize, fractionalize, and marginalize EW issues. EW programs are subject to service branch funding. Service branch downsizing and budget cuts have severely affected EW system availability and expertise. Currently, the U.S. Air Force is minimizing EW expertise under the guise of force-shaping, while the Navy is downsizing the EW force as they transition from the two EW position Prowler to the single EW position, air centric, technology focused EA-18G Growler (U.S. Air Force Air Staff Representative, 2007 and Gershanoff, 2002). Eventually, the U.S. Marines will lose their organic airborne EW capability after the Prowler is retired. The result of the downsizing and budget cuts are seen in the symptoms of EW deficiencies. The Air Force is further dividing EW with the establishment of the Cyber warfare Command separate from EW.

Stripped of all the fanfare, cyberspace is restrained by the physical limitations of the EME. The cyber world potential affect on information flow and national security is enormous; however, the military has created a separate command to counter one weapon. Cyber equipment is really just a weapons system, like RADARs or radios that use the EME to pass information. Recent Air Force headquarters discussions are that EW would become a subset of the cyber command. An Air Force Headquarters Staff individual involved in the cyber command discussion acknowledged the EW officers involved in the

discussion "are concerned about the impact to overall EW development, funding, force management if we [EW organizations] are just a subset of computer network operations" (U.S. Air Force Air Staff Representative, 2007). This structure is equivalent to having the McDonalds person trained only in making fries running the entire store. One way to overcome this potential structural disparity is to harness EW network power by establishing quasi-formal relationships with non-military EW organizations.

The strongest and most influential non-military EW organization is the Congressional EW Working Group (EWWG), headed by Congressmen Joseph R. Pitts. The JEWC as the central EW node should establish a standing formal relationship through frequent (i.e. quarterly) meetings with the EWWG. Frequent coordination will establish rapport and provide the military community an opportunity to improve the EW knowledge on Capital Hill. Eventually, this relationship should positively affect DoD acquisition for vital EW systems. Recommendations to establish relationships with non-military EW organizations are extended to professional, commercial EW organizations like the Association of Old Crows (AOC). These organizations have significant political influence, commercial network relationships, and financial interest in EW. Relationships with these organizations must be tempered and individuals actively pursing these relationships must be cognizant of the biased financial motivations of these organizations. Quasi-formal relationships with non-military EW organizations can be mutually beneficial for the U.S. military.

2. Formal Graduate Level Accredited Education

Success for the command level EW organization's internal restructuring efforts also depends changes to formal EW education. The Oxford Handbook of Organization Theory (2003) states "Organizations today have to be intelligent, have a learning capacity built-in." (p. 558). Mandatory training that is standardized by a centralized organization can establish the organizational learning capacity required to adapt. The responsibility of the central organization is to manage the training. The JEWC would assume the role of the central organization responsible for graduate level training.

Currently, the JEWC training office is developing a formalized training concept. (See Appendix F.)[16] The concept is in the initial stages of development; therefore, it has not matured to include specifics for contextual differentiation and succession requirements to ensure minimal overlap between courses. These recommendations expand on the preliminary JEWC concept.

The training goal is to increase Joint EW and IT system knowledge and minimize individual cognitive biases through continuing education. People cannot be EW experts after attending one three-week class. The centralized Joint EW education system will have two sections- continuing education and mandatory training based on assignment.

EW continuation education training is based on the civilian requirements for professional service agencies like teachers, doctors, speech pathologists, etcetera. Completion of continuing education related to EW would be required every two to three years. Continuing educational courses will focus on one aspect or a combination of the following subjects: EW exploit, attack, and protect considerations; Joint EW systems and employment tactics; and new technologies and their affect on EW execution. Training is provided through various means to include seminars, conferences, and the internet. Most continuation training can be accomplished on-line. The JEWC would annually identify accredited courses or conferences approved to fulfill training requirements. Mandatory EW continuation training will be in addition to the current PME structure.

The second section of the Joint EW education system is mandatory training based on job assignment. This training only will be required prior to or immediately after assignment to select command level EW positions. The JEWC should form an action group to identify these positions. This group would include JCEWS, JTF EW, and service branch senior EW staff positions as a minimum. After completing job specific training, a prefix should be added to the individual's military occupational specialty code. This prefix will assist the service assignment people responsible for matching individuals to jobs. Additionally, earning the specialty code will elevate knowledge, standardize

[16] Appendix G is a graphical representation of the Berg-Stotts training pyramid (BS Training Pyramid) concept. The concept is unclassified, but it is part of a classified briefing on EW provided by the JEWC. For a copy of the BS training pyramid and more information on the training concept, please contact the JEWC: Phone: 210-977-5976 / e-mail JEWCTraining@jiowc.osis.gov.

experiences and minimize the differences between individuals assigned to key command level EW positions. This will improve the trust and decrease OJT regression as individuals PCS. Individual inconsistencies, lack of trust, and PCS-OJT regression cycles were significant misfits identified in the analysis that contributed to EW stagnation.

The JEWC, as the central agency, will manage the training; however, manpower limitations mean service branches must actively support and supplement the Joint EW education system. The JEWC will provide some courses; however, service branches will need to be the lead agencies on the development and funding of a majority of the different courses/conferences. Each courses/conferences that satisfy the EW education requirements must be accredited by the JEWC to ensure currency and applicability. Accredited courses/conferences are identified annually on the JEWC website. If required, the list can be updated quarterly.

Instituting a mandatory education system for the entire U.S. military EW community will be extremely challenging and costly in terms of money and time. Bolman and Deal (2003) explain that organizations must “invest in employees” if they are to be successful (p. 142). The first requirement for the EW education system to be successful is approval by the service branches. Service branches must formally agree to provide support, funding, manpower, and supplement training programs. Without formal support, the system cannot overcome the oppressive bureaucratic structure dividing the EW organizations. Assuming formal support is achieved, the next problem is tracking the training. Tracking can be managed electronically through a properly manned JEWC training branch. After earning an EW associated specialty code, individual names will be provided to the JEWC. The JEWC will identify individuals and establish a web-based tracking program. Consequences for not accomplishing training will have to be determined and agreed upon by service branch’s and agencies.

A mandated, formalized EW education system may seem a daunting task, but if it is not instituted the U.S. military will be, if we agree with Greek historian Thucydides, “fools”. He said; "A nation that makes a great distinction between its scholars and its warriors will have its thinking done by cowards and its fighting done by fools"

(Thucydides, 2007). Education is required to keep pace with adversaries that America will face in the twenty-first century. How adversaries use the EME also affects how EW organizations should be structured.

3. Product Based Divisional Structure

The collective assessment determined that the divisionalized structure of command level EW organizations is an acceptable structure to accomplish it task. The diversity of services, complexity of the task, and geographic separation of EW organizations require the attention to detail, fast response time, and decentralized authority associated with a divisional structure. However, symptoms of deficiency identified in the introduction could mean the current divisional structure is not appropriate to meet the EW demands of the twenty-first century.

Burton and Obel (1998) recommend the sequential order to divide labor is "products, markets, and customers" (p. 45). Currently, EW labor is divided by customer first, then market, and finally product. EW customer labor division is the largest and broadest. EW equipment and personnel is divided by type of EW mission (ES, EA, EP). The assigned specialty code and initial job specific training represents this labor division. Market labor division is represented by the geographic commands. Finally, the third labor division is by product, which is based presently on the individual service capabilities[17]. Though this division of labor order was effective in the past, but it is not today.

The military service based bureaucratic structure of EW is not able to adapt quickly or economically to the various dynamic inputs. Environmental changes with the hybridization of military and commercial systems; fourth generation warfare evolution; and exponential growth in information technology all have contributed to the problems

[17] An following is an example to illustrate the EW labor division order: Individuals are first trained in electronic warfare and given an EW specialty code. They are further trained in the attack mission, which adds a mission designator to their specialty code. Customers requiring EA would request this person. The coded individual is the assigned to a unit in a COCOM or functional command. This assignment provides the market where the individual executes the mission for the customer. Finally, the individual is trained on a specific piece of equipment or to perform a specific capability. In this case, the EC-130H COMPASS CALL. This is the product. Combined this is stated as the customer requests an EA mission in the Europe market using the EC-130H COMPASS CALL product.

experienced by EW. IT evolutions have disruptive capabilities that require changes in EW warfare concepts. The impact of the machine gun on battlefield strategy is equivalent to the impact IT has on the EW battlefield. The U.S. DoD can no longer expect to line up in unprotected electronic rows and fire off electrons at a known enemy without taking severe electronic and physical casualties. To avoid information casualties, it is recommended that the divisional structure of the EW community be internally modified in the order suggested by Burton and Obel (1998, p. 45): products, markets, and then customers.

The current paradigm for the EW product is that individual widgets owned by the service branches and used to execute the tactical EW mission is the product. Command level EW organizations plan and manage these products. It is recommended to change the product paradigm from service specific to a functional concept. Instead of identifying individual systems, the product is defined by the impact of the information system on the EM and physical environments. The product considers the amount of EM spectrum covered and the physical effective range of the system. The product division is further divided into global, regional, national, and local sub-division. Global EW will focus on information systems that have a universal reach like the internet; cyber world; and long wavelength, low frequency communications systems. Regional EW concentrates on information systems that cross sovereign boundaries, but are constrained to global regions. These systems include Global System for Mobile communications (GSM) cell phones, satellite communications with limited footprints like THURAYA, and localized global positioning systems (GPS). National EW systems are systems tied exclusively to a particular nation, which includes Integrated Air Defense Systems (IADS), airborne EW counter measures and specific military or commercial systems only used in that nation. Finally, the focus of the local sub-division is on information systems with limited range and not tied exclusively to a specific nation. Local systems include infrared spectrum devises, lasers, high-powered cordless phones, and portable family radio systems. EW trained personnel in the DoD would first be educated in these products versus a specific

EW mission. Education would provide comprehensive understanding of system applications, identify system vulnerabilities to attack and exploitation and will inform users about interoperability issues with other information warfare systems.

The rationale for placing this type of product as the primary divider of EW labor is information systems used and protected by the U.S. are also the same systems that are attacked or exploited. Having a working knowledge of the system as a whole will allow better defense, exploitation, and attacking strategies required to maintain the information advantage. Migration from service system based to functional product based education is not easy. It requires substantial, but achievable, modifications to the current undergraduate EW educational system. The recommended continuing education system can complement the undergraduate efforts to make this paradigm shift successful.

The labor divisions of markets and customers would not require any paradigm shifts or modifications to the existing infrastructure. Markets would remain the secondary division of labor and be divided by geographic regions. This division allows regional flexibility and has proven fairly effective to ensure regional expertise and reach of the limited assets within the bureaucratic constraints of the DoD. The customer would be the tertiary division and would remain structured by the EW mission required. Customers wanting EA would still work with EA specialists. The difference in the new structure is the EA expert will now be a regional expert with knowledge of other assets and affect the tactical EA mission requested will have on operations.

4. Recommendation Final Thoughts

The recommendations for restructuring take advantage of the JEWC as the central EW node. It is important to provide a centralize network for command level EW organizations to plan and manage EW to adapt effectively to twenty-first century dynamic environments. What is not recommended is to further divide the EW mission. The efforts, already discussed, of the USAF to stand up a separate cyber command further divides the EW mission. The advantage of separating CNO from the rest of EW is that CNO has a direct link to the decision makers. Therefore, CNO is automatically elevated above the bureaucratic noise threshold. Once above the noise threshold, money

and manpower are thrown the organization's way. Increased money and manpower do not always equal success. The creation of a separate Cyber Command does ensure creation of another organizational stovepipe; increased rivalries over limited resources and defined areas of responsibilities; and more barriers to coordination. The impact of dividing organizations coordinating EW is seen in Washington Post columnist Rick Atkinson's (Atkinson, 2007) article on the counter-IED mission. The DoD created the Joint IED Defeat Organization (JIEDDO) to counter IED's. Seventy-five plus people and a billion-dollar budget comprises JIEDDO, which developed a mission to drive the terrorist off the airways and "back to the wire." The result was an initial EW success; however, efforts only marginalized a small portion of the IED threat. While the terrorists become more experienced and deadlier with the institution of explosively formed penetrator's (EFP), interoperability issues and inter-service rivalries, created by disjointed acquisition structure, degrade U.S. effectiveness.

Purposely not addressed in this section is the movement of EW from the J3 Operations IO Cell to the Effects Cell. Libicki's (1995) argument that EW is "tactical at best" because of its limitations supports the movement of EW from the strategic IO cell to the tactical effects cell (Ch. 11, p. 2). Additionally, the lack of authority and bureaucratic layering under the IO cell has proven to degrade effectiveness of EW to accomplish its tasks. Active debates on the advantages and disadvantages of the movement within the joint organizational structure are heated. Based on this analysis, the problems with effectively planning and managing EW cannot be solved by just being administratively assigned to the IO Cell. There are fundamental flaws in the EW design structure that must be first addressed, as a joint community, if it is to be successful. Lateral administrative shifts will not alone over come these challenges.

The Oxford Handbook of Organizational Theory (2003) states "the emphasis [on current organizational structure] is on a shift from older, more imperative methods of managerial fiat, based on prescription, command, and control, to empowerment, teamwork, and networked relations" (p. 558). Adversarial forces also use many of the information systems used by the U.S. This means systems that America attacks or exploits are also systems the U.S. must spend time protecting. Contributing factors such

as cost, scarcity of assets, classification restrictions within the community, inter-service rivalries, slow acquisition process, training deficiencies, and authoritative limitations further complicates command level EW organizations' task to effectively plan and manage EW. Overcoming these challenges must be a joint effort with empowered teams connected by networks.

B. CONCLUSION

Acting as the cardiovascular system of the United States military, Electronic Warfare organizations ensures information flows like oxygen from and across the forward lines, Department of Defense, and National Command Authority. The 2006 National Security Strategy recognized that maintaining the information flow advantage is vital to the nation's national security (p. 47). Exploitation failures prior to the 2001 terrorist bombings, attack problems encountered in the C-RCIED campaign, and protection vulnerabilities exposed by TITAN RAIN demonstrate symptoms of EW decline and loss of information flow advantage. Command level EW organizations are formally tasked by joint publications to manage and plan EW to maintain information flow advantages and protect national security. This thesis used the combined open systems model and Burton and Obel's (1998) ORGCON expert system to analyze the congruence of command level EW organizations within the DoD structure.

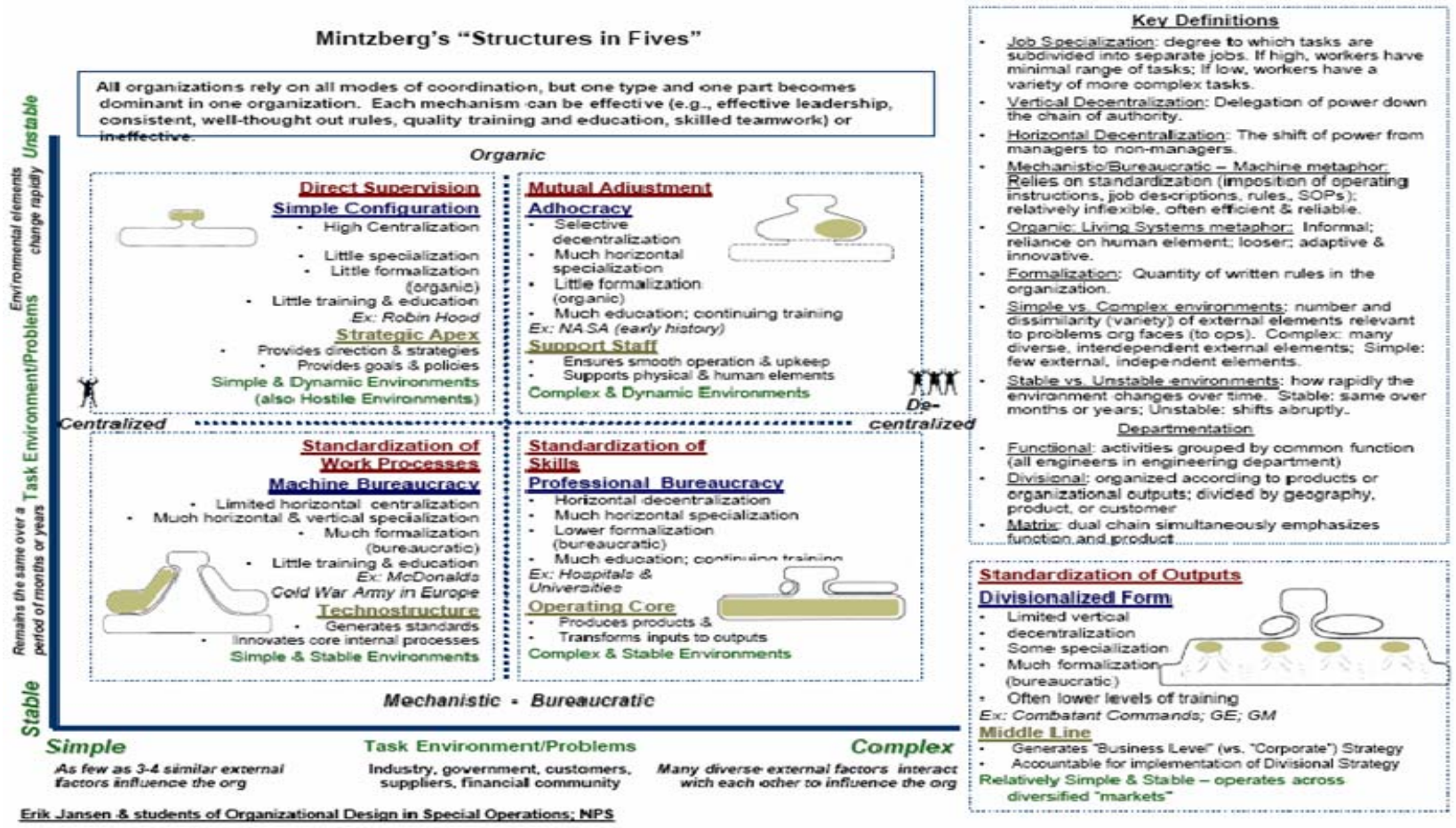
The collaborative assessment identified multiple fit issues between the EW structure and its assigned task of EME control. These misfits are interpreted as an organizational failure to adequately adjust to the dynamic inputs of evolutionary changes in the conduct of warfare, communication technology; and the hybridization of military and commercial communication systems. Conclusions state that these misfits were a result of an unachievable strategic task, weak authoritative command structure, inadequate formal training and education, and an ineffective divisional structure.

Recommendations to compensate for these misfits were presented with the understanding of the constraints of the bureaucratic environment within which command level EW organizations operate. Analyses recommended a centralized, yet flexible structure to facilitate the organization to accomplish tasks and adapt to the dynamic

environment. Symantec changes to the strategic tasks, modifications to EW leadership rank structure, formalized graduate level EW training, and reprioritizing EW divisionalized structure on a product-based system will facilitate adaptation to future changes.

Implementing change is not easy, especially in a bureaucratic system. Individual observations and recommendations presented will be challenged; however, the background and symptoms provided make it hard to deny that current command level EW organizations have stagnated and are struggling to achieve their task of EME control. If the U.S. is to remain, a powerful nation state it must maintain its information flow advantage in the twenty first century throughout the range of military operations. Changes in the planning and management of EW are required now before the symptoms get worse. Failure to implement corrective changes to command level EW planning and management can lead to the U.S. military being physically defeated because it was electronically crippled.

APPENDIX A. SUMMARY CHART OF HENRY MINTZBERG'S CONGRUENCE STRUCTURE BY ERIK JANSEN, NPS



Reference: (Jansen, 2007)

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APPENDIX B. CHRONOLOGICAL LIST OF KEY EVENTS IN EW HISTORY

Year	EW Development
1837-44	- Samuel Morse perfects telegraph for communication
1844-75	- Telegraph Used for extensive Command and Control (C2) in Civil War - 1st Documented Electronic Attack against Telegraph in Civil War - 1858- transatlantic telegraph - 1860- Antonio Meucci invents telephone
1875-95	- Alexander Graham Bell commercializes telephone
1895-1914	- Guglielmo Marconi develops radio for airways communication - Patented by Nikola Tesla - World War One extensive use of Radio and telephone for C2 - Electronic Attack denial jamming and deception tactics developed
1914-1935	- 1st transcontinental and transoceanic radio waves
1935-45	- Sir Robert Alexander Watson-Watt Invention of radar - Radar and Radio improvements used in WW II for C2 and Surveillance - EA tactics of deception, denial, and degrade extended to radar and radio waves
1945-1962	- Cold War separation of Commercial and Military electronic systems - 1962- Communications satellite act and launch of TELSTAR and RELAY systems - Systems funded by US government but commercial endeavors - Satellite extensive use of communication and reconnaissance demonstrated by Cuban Missile Crises
1962-89	- End of Cold War, increase in commercial-off-the-shelf (COTS) technology COTS and sale of military technology begins hybridization of military and commercial communication, surveillance, and attack systems - 1961 Jack Kilby and Robert Noyce invent microchip - 1968 Robert Noyce invents microprocessor - Rise of commercial computers, satellite systems, and cellular phones
1989-2001	- Gulf War- Last Conventional warfare operation - US displayed dominance of EM spectrum. - 1990's- Exponential growth in electronic technology market with significant decrease in cost - Rise of remote piloted vehicles (RPVs) and dependency on Global Positioning System (GPS) for military weapons and C2 - Allied Force- Electronic challenges as a result of hybridization of commercial and military systems exposed to include GPS dependency and vulnerability
2001-2007	- Internet, Cell phone, high powered cordless phones, and wireless technology explosion - Showcase of transnational organizations using commercial C2 - Resurgence of unconventional warfare in urban environments demonstrated requirement for US to control EM spectrum against multitude of C2 COTs systems to include Radio-Controlled Improvised Explosive Devices (RC-IEDs) and wireless communication voice and digital systems

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APPENDIX C. JP 3-13.1 DEFINED JCEWS RESPONSIBILITIES

Reference: (JP 3-13.1, 2007, pp. II-4-II-6)

(1) Specific functions and responsibilities of a JCEWS:

(a) Be familiar with EW support to current theater OPLANs and CONPLANs
(b) Prepare EW portion of estimates and tabs to joint force OPLANs
(c) Formulate and recommend EW targets to support the JFC OPLAN
(d) Implement EW policies

(2) Functions and responsibilities common to JCEWS and joint EWCC (When a JCEWS and joint EWCC exist at the same level, the owning commander must decide command and coordination relationships between the two organizations).

(a) Provide EW planning and coordination expertise to the JFC. Develop a daily EW battle-rhythm that supports EW planning and operations requirements
(b) Prepare the EW portion of estimates and tabs for operation orders (OPORDs) and identify authorities necessary to implement the OPORD
(c) Identify requirements for intelligence support to joint EW operations, including assistance to the J-2 in planning the collection and dissemination of ES information
(d) Define and develop intelligence requirements to support EW operations
(e) Coordinate with ISR assets and national agencies in assessing hostile EW capabilities
and limitations
(f) Coordinate with ISR and national resources to weigh intelligence gain/loss of EA or
the physical destruction of targets, and if necessary, coordinate the resolution of these conflicts. Resolution of intelligence gain/loss conflicts resides with the JFC.
(g) Plan, coordinate, and assess defensive EA requirements
(h) Maintain current assessment of the EW resources available to the JFC (to include
number, type, and status of EW assets) and analyze what resources are necessary to accomplish the JFC's objective
(i) Assist JFC by recommending the level of EW support required of the component
commanders
(j) Prioritize EW targets based on the JFC's objectives, EW plan and available assets
(k) Represent EW within the IO cell to formulate and recommend to the joint targeting
coordination board EW targets to support the JFC's plan
(l) Predict effects of friendly and enemy EW activity on joint and multinational operations using applicable modeling and simulation tools
(m) Plan, coordinate, and assess EP (e.g., EW deconfliction, EMCON, EW

reprogramming)

(n) Assist JFMO in conjunction with JFC J-2, J-3, J-6, other government agencies, joint special operations center, components, and allies in resolving spectrum conflicts that JFMO or JCEWS are unable to resolve

(o) Carry out responsibilities of the jamming control authority (JCA)

(p) Coordinate and monitor joint coordination EW reprogramming (JCEWR) by identifying where EW reprogramming decisions and reprogramming actions affect joint force tactical operations and disseminating theater-wide EW plans as required

(q) Recommend and promulgate EW special instructions and rules of engagement (ROE)

(r) Plan, coordinate, integrate, and deconflict EW in current and future operations taking in consideration nontraditional capabilities (e.g., IO, space, special operations, and STO) within the operational area

(s) Compile and coordinate EW support requests from all components according to the priorities set by the JFC

(t) Coordinate through the chain of command to resolve any component/multinational EW requests that cannot be solved at the JCEWS or joint EWCC level

(u) Monitor and adapt execution of EW plans in current operations and exercises

(v) Archive EW planning and execution data and document EW lessons learned in accordance with the joint lessons learned program

(3) Joint EWCC Support Requirements**.** When activated, the EWCC should be located in or have access to a special compartmented information facility to permit thorough accomplishment of its coordinating functions. Optimal joint EWCC staffing will dictate the inclusion of STO cleared personnel in order to coordinate and deconflict STO issues. The joint EWCC will also have requirements for administrative, intelligence, logistics, legal and communications support.

(a) Administrative. Administrative support will include, but not be limited to, clerical assistance, classified material control, publications management, update, maintenance and display of operational SIGINT data, and the provision of general administrative materials.

(b) Intelligence. The joint EWCC will require all-source intelligence information to maintain full knowledge of an opposing force's intentions and capabilities. Intelligence support will include specific and detailed combat information, intelligence, and ES information for example: opposing force electronic systems; scheme of maneuver; communications system capabilities and deployment; electronic-dependent weapon systems capabilities and deployment; as well as EW activities, and SIGINT collection plans of friendly units. The J-2 will coordinate with theater EW units to ensure mission reports are received in a timely manner and disseminated to the staff and other agencies as required.

(c) Logistics. Logistic support for the joint EWCC includes, but is not limited to: storage containers for classified material; desks; maps; information display facilities; messing and billeting of assigned personnel.

(d) Communications. The Joint EWCC should advise J-6 of the staff's communication
requirements. These requirements depend directly on the level of EW activities involved in joint task force (JTF) operations. Provisions must be made for secure, reliable, and timely communications support. The joint EWCC should be able to communicate with both component EW authorities/agencies and appropriate external authorities concerning coordination of EW activities. The joint EWCC must also be able to communicate with coalition partners within releasability restraints.

(e) Legal. Support for the joint EWCC includes legal support to review and obtain the necessary authorities and to review the plan for compliance with ROE and applicable domestic and international law, including law of armed conflict (LOAC).

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APPENDIX D. ORGANIZATIONAL CONSULTANT RESULTS

Reference: (Burton *et al.*, 1998)

UP TO AND INCLUDING GULF WAR (1991)

Output"
REPORT SUMMARY - Command Level EW

Time: 9:05:02 PM, 10/15/2007
Scenario: 1986-1991 (Gulf War)

INPUT DATA SUMMARY

The description below summarizes and interprets your answers to the questions about your organization and its situation. It states your answers concerning the organization's current configuration, complexity, formalization, and centralization. Your responses to the various questions on the contingencies of age, size, technology, environment, management style, cultural climate and strategy factors are also given. The writeup below summarizes the input data for the analysis.

- Command Level EW has a machine bureaucracy configuration (cf 100).
- Command Level EW has a large number of different jobs (cf 100).
- Of the employees at Command Level EW 76 to 100 % have an advanced degree or many years of special training (cf 100).
- Command Level EW has 6 to 8 vertical levels separating top management from the bottom level of the organization (cf 100).
- The mean number of vertical levels is 6 to 8 (cf 100).
- Command Level EW has 16 to 30 separate geographic locations (cf 100).
- Command Level EW's average distance of these separate units from the organization's headquarters is more than 3500 miles (cf 100).
- 61 to 90 % of Command Level EW's total workforce is located at these separate units (cf 100).
- Job descriptions are available for all employees, including senior management (cf 100).
- Where written job descriptions exist, the employees are supervised closely to ensure compliance with standards set in the job description (cf 100).
- The employees are allowed to deviate very little from the standards (cf 100).
- 41 to 60 % non-managerial employees are given written operating instructions or procedures for their job (cf 100).
- The written instructions or procedures given are followed to a great extent (cf 100).

- Supervisors and middle managers are to a little extent free from rules, procedures, and policies when they make decisions (cf 100).
- More than 80 % of all the rules and procedures that exist within the organization are in writing (cf 100).
- Top Management is to a great extent involved in gathering the information they will use in making decisions (cf 100).
- Top management participates in the interpretation of 61 to 80 % of the information input (cf 100).
- Top management directly controls 61 to 80 % of the decisions executed (cf 100).
- The typical middle manager has little discretion over establishing his or her budget (cf 100).
- The typical middle manager has little discretion over how his/her unit will be evaluated (cf 100).
- The typical middle manager has little discretion over the hiring and firing of personnel (cf 100).
- The typical middle manager has no discretion over personnel rewards - (ie, salary increases and promotions) (cf 100).
- The typical middle manager has some discretion over purchasing equipment and supplies (cf 100).
- The typical middle manager has little discretion over establishing a new project or program (cf 100).
- The typical middle manager has little discretion over how work exceptions are to be handled (cf 100).
- Command Level EW has 500 employees (cf 100).
- Command Level EW's age is mature (cf 100).
- Command Level EW's ownership status is public (cf 100).
- Command Level EW has many different products (cf 100).
- Command Level EW has many different markets (cf 100).
- Command Level EW operates at a high-activity level in more countries (cf 100).
- Command Level EW has an undetermined number of different products in the foreign markets (cf 100).
- Command Level EW's major activity is categorized as service (cf 100).
- Command Level EW has a standard high-volume service technology (cf 100).
- Command Level EW has a medium routine technology (cf 100).
- Command Level EW's technology is somewhat divisible (cf 100).
- Command Level EW's technology dominance is average (cf 100).
- Command Level EW has either planned or already has an advanced information system (cf 100).
- Command Level EW's environment is complex (cf 100).
- The uncertainty of Command Level EW's environment is low (cf 100).
- The equivocality of the organization's environment is low (cf 100).
- Command Level EW's environment has a high hostility (cf 100).
- Top management prefers to make resource allocations and detailed operating decisions (cf 100).

- Top management primarily prefers to make both long-term and short-time decisions (cf 100).
- Top management has a preference for very detailed information when making decisions (cf 100).
- Top management has a preference for some proactive actions and some reactive actions (cf 100).
- Top management is risk averse (cf 100).
- Top management has a preference for high control (cf 100).
- Command Level EW operates in an industry with a high capital requirement (cf 100).
- Command Level EW has a medium product innovation (cf 100).
- Command Level EW has a low process innovation (cf 100).
- Command Level EW has a high concern for quality (cf 100).
- Command Level EW's price level is undetermined relative to its competitors (cf 100).
- The level of trust is low (cf 100).
- The level of conflict is medium (cf 100).
- The employee morale is medium (cf 100).
- Rewards are given in a not known fashion (cf 100).
- The resistance to change is high (cf 100).
- The leader credibility is medium (cf 100).
- The level of scapegoating is medium (cf 100).

THE SIZE

The size of the organization - large, medium, or small - is based upon the number of employees, adjusted for their level of education or technical skills.

Based on the answers you provided, it is most likely that your organization's size is large (cf 100).

More than 75 % of the people employed by Command Level EW have a high level of education. Adjustments are made to this effect. The adjusted number of employees is greater than 2,000 and Command Level EW is categorized as large.

THE CLIMATE

The organizational climate effect is the summary measure of people and behavior.

Based on the answers you provided, it is most likely that the organizational climate is a internal process climate (cf 79).

The internal process climate is a formalized and structured place to work. Procedures govern what people do. The leaders pride themselves on being good coordinators and organizers. Maintaining a smooth running organization is important. The long-term

concerns are stability, predictability, and efficiency. Formal rules and policies hold the organization together.

When the organization has a low level of trust, it is likely that the organization has a internal process climate. Employees with a medium to low morale is frequently one element of an internal process climate. High resistance to change is normally present in a internal process climate.

THE MANAGEMENT STYLE

The level of management's microinvolvement in decision making is the summary measure of management style. Leaders have a low preference for microinvolvement; managers have a high preference for microinvolvement.

Based on the answers you provided, it is most likely that your management profile has a high preference for microinvolvement (cf 82).

It could also be that your management profile has a medium preference (cf 78).

Since the management has a preference for being very involved in gathering and using detailed information when making decisions, a high preference for microinvolvement characterization is appropriate. Management is risk averse. This is one of the characteristics of a manager with a high preference for microinvolvement. Management has a preference for using control to coordinate activities, which leads toward a high preference for microinvolvement.

The management of Command Level EW has a preference for letting some decisions be made by other managers. This will lead toward a medium preference for microinvolvement. Management has both a short-time and long-term horizon when making decisions, which characterizes a preference for a medium microinvolvement. The management of Command Level EW has a preference for taking actions on some decisions and being reactive toward others. This will lead toward a medium preference for microinvolvement.

THE STRATEGY

The organization's strategy is categorized as one of either prospector, analyzer with innovation, analyzer without innovation, defender, or reactor. These categories follow Miles and Snow's typology. Based on your answers, the organization has been assigned to a strategy category. This is a statement of the current strategy; it is not an analysis of what is the best or preferred strategy for the organization.

Based on the answers you provided, it is most likely that your organization's strategy is an analyzer with innovation strategy (cf 81).

An organization with an analyzer with innovation strategy is an organization that combines the strategy of the defender and the prospector. It moves into the production of a new product or enters a new market after viability has been shown. But in contrast to an analyzer without innovation, it has innovations that run concurrently with the regular production. It has a dual technology core.
For a medium routine technology, Command Level EW has some flexibility. It is consistent with an analyzer with innovation strategy. With a concern for high quality an analyzer with innovation strategy is a likely strategy for Command Level EW.

THE CURRENT ORGANIZATIONAL CHARACTERISTICS

Based on your answers, the organization's complexity, formalization, and centralization have been calculated. This is the current organization. Later in this report, there will be recommendations for the organization.

The current organizational complexity is high (cf 100).

The current horizontal differentiation is high (cf 100).

The current vertical differentiation is medium (cf 100).

The current spatial differentiation is high (cf 100).

The current centralization is high (cf 100).

The current formalization is high (cf 100).

The current organization has been categorized with respect to formalization, centralization, and complexity. The categorization is based on the input you gave and does not take missing information into account.

SITUATION MISFITS

A situation misfit is an unbalanced situation among the contingency factors of management style, size, environment, technology, climate, and strategy.

The following misfits are present: (cf 100).

When the equivocality of Command Level EW's environment is low, the analyzer with innovation strategy may not be a suitable one! With low equivocality, the environment is well known and understood. An innovative strategy works best when the environment offers new opportunities for products and services. Here such opportunities are limited. However, process innovation which reduces costs is appropriate.
Command Level EW has an internal process climate. This is a mismatch with analyzer with innovation strategy! An internal process climate is internally oriented with a focus on control. Innovation is difficult to achieve with this orientation. More flexibility and a more external orientation are desirable for innovation. An internal process climate supports better an analyzer without innovation and defender strategy.

ORGANIZATIONAL CONSULTANT RECOMMENDATIONS

Based on your answers about the organization, its situation, and the conclusions with the greatest certainty factor from the analyses above Organizational Consultant has derived recommendations for the organization's configuration, complexity, formalization, and centralization. There are also recommendations for coordination and control, the appropriate media richness for communications, and incentives. More detailed recommendations for possible changes in the current organization are also provided.

ORGANIZATIONAL CONFIGURATIONS

The most likely configuration that best fits the situation has been estimated to be a divisional configuration (cf 85).

It is certainly not: a professional bureaucracy (cf -1).

It is certainly not: a machine bureaucracy (cf -100).

A divisional organization is an organization with self-contained unit grouping into relatively autonomous units coordinated by a headquarters, (product, customer, or geographical grouping).
When the organization is large, the configuration can be a divisional configuration. Because the organization has many products, the configuration should be divisional. The configuration should be divisional when the equivocality of Command Level EW's environment is not high and the complexity is not low. The divisionalization of Command Level EW may be based on products or product groups. The divisionalization of Command Level EW may be based on markets. The divisional configuration may be a multi-domestic structure.
Because the technology is not fully divisible, care should be taken in recommending a divisional configuration.

A professional bureaucracy is a less likely configuration when top management has a high preference for microinvolvement.
When the organization has high hostility, it is unlikely to be a machine bureaucracy. A machine bureaucracy will prevent it from acting appropriately when unexpected events occur.

ORGANIZATIONAL CHARACTERISTICS

The recommended degree of organizational complexity is medium (cf 53).

It, too, could be: low (cf 45).

Large public organizations should have medium to high organizational complexity. Command Level EW has a technology that is somewhat routine, which implies that the organizational complexity should be medium. When the uncertainty of Command Level EW's environment is low, the organizational complexity should neither be very low nor very high so that Command Level EW will be able to react quickly when the environment changes. Because Command Level EW has an advanced information system, organizational complexity can be greater than it could otherwise.

When the environmental hostility of Command Level EW is high, organizational complexity should be low. Top management of Command Level EW has a preference for a high level of microinvolvement, which leads to lower organizational complexity.

The recommended degree of horizontal differentiation is low (cf 45).

The recommended degree of vertical differentiation is low (cf 72).

The recommended degree of formalization is high (cf 67).

There should be high formalization between the organizational units but less formalization within the units due to the high professionalization. When the organization uses an advanced information system, formalization should be high. Command Level EW has a high capital requirement, which leads to high formalization. Large organizations should have high formalization. High formalization is consistent with top management's preference for a high level of microinvolvement. An internal process climate in the organization requires a high level of formalization.

The recommended degree of centralization is high (cf 57).

There is evidence against it should be: low (cf -2).

When there is a high capital requirement and the product innovation is medium, as is the case for Command Level EW, centralization should be rather high to obtain efficiency. When the environment is hostile, prompt actions by top management may be required and high centralization should be considered. High centralization is required if top management has a preference for a high level of microinvolvement. Because Command Level EW has an advanced information system, centralization can be greater than it could otherwise. An internal process climate in the organization requires a medium to high level of centralization.

Command Level EW's span of control should be moderate (cf 62).

Since Command Level EW has some technology routineness, it should have a moderate span of control.

Command Level EW should use media with low media richness (cf 100).

The information media that Command Level EW uses should provide a moderate amount of information (cf 85).

Incentives should be based on procedures (cf 85).

Command Level EW should use rules as means for coordination and control (cf 88).

With low equivocality, low uncertainty, and high complexity in Command Level EW's environment, coordination and control should be rules and procedures. A moderate amount of information must be considered, although it need not be rich for this low uncertainty and low equivocality environment. Incentives should be based on procedure, thus focusing on performing activities well. Coordination within each division is very important. Coordination between (among) divisions is usually relegated to top management, which is also concerned about strategic direction and allocation of funds between (among) the divisions. Technology efficiencies can be obtained by sharing technology, information and new developments across divisions. Liaison managers and technology committees are possible coordination mechanisms. Conferences among technical professionals can be very effective.

The recommended structure for Command Level EW is a divisional structure. This structure requires a top management, which will pay attention to strategic issues and problems. The top management's preference for a high microinvolvement does not fit with the divisional structure. It will likely turn out to be a corrupted divisional structure (Williamson, 1975).

ORGANIZATIONAL MISFITS

Organizational misfits compare the recommended organization with the current organization.

The following organizational misfits are present: (cf 100).

Current and prescribed configuration do not match.
Current and prescribed complexity do not match.

MORE DETAILED RECOMMENDATIONS

No detailed recommendations present (cf 100).

Based on the present input Organizational Consultant was not able to make any detailed recommendations.

END

POST GULF WAR (1991) TO PRESENT

Output:

REPORT SUMMARY - Command Level EW

Time: 9:16:56 PM, 10/15/2007
Scenario: Post 1991-2007

INPUT DATA SUMMARY

The description below summarizes and interprets your answers to the questions about your organization and its situation. It states your answers concerning the organization's current configuration, complexity, formalization, and centralization. Your responses to the various questions on the contingencies of age, size, technology, environment, management style, cultural climate and strategy factors are also given. The writeup below summarizes the input data for the analysis.

- Command Level EW has a machine bureaucracy configuration (cf 100).
- Command Level EW has a large number of different jobs (cf 100).
- Of the employees at Command Level EW 76 to 100 % have an advanced degree or many years of special training (cf 100).
- Command Level EW has 6 to 8 vertical levels separating top management from the bottom level of the organization (cf 100).
- The mean number of vertical levels is 6 to 8 (cf 100).
- Command Level EW has 16 to 30 separate geographic locations (cf 100).
- Command Level EW's average distance of these separate units from the organization's headquarters is more than 3500 miles (cf 100).
- 61 to 90 % of Command Level EW's total workforce is located at these separate units (cf 100).
- Job descriptions are available for all employees, including senior management (cf 100).
- Where written job descriptions exist, the employees are supervised closely to ensure compliance with standards set in the job description (cf 100).
- The employees are allowed to deviate very little from the standards (cf 100).
- 81 to 100 % non-managerial employees are given written operating instructions or procedures for their job (cf 100).
- The written instructions or procedures given are followed to a great extent (cf 100).
- Supervisors and middle managers are to a little extent free from rules, procedures, and policies when they make decisions (cf 100).
- More than 80 % of all the rules and procedures that exist within the organization are in writing (cf 100).

- Top Management is to a great extent involved in gathering the information they will use in making decisions (cf 100).
- Top management participates in the interpretation of 61 to 80 % of the information input (cf 100).
- Top management directly controls more than 80 % of the decisions executed (cf 100).
- The typical middle manager has little discretion over establishing his or her budget (cf 100).
- The typical middle manager has little discretion over how his/her unit will be evaluated (cf 100).
- The typical middle manager has little discretion over the hiring and firing of personnel (cf 100).
- The typical middle manager has little discretion over personnel rewards - (ie, salary increases and promotions) (cf 100).
- The typical middle manager has some discretion over purchasing equipment and supplies (cf 100).
- The typical middle manager has some discretion over establishing a new project or program (cf 100).
- The typical middle manager has some discretion over how work exceptions are to be handled (cf 100).
- Command Level EW has 500 employees (cf 100).
- Command Level EW's age is mature (cf 100).
- Command Level EW's ownership status is public (cf 100).
- Command Level EW has many different products (cf 100).
- Command Level EW has many different markets (cf 100).
- Command Level EW operates at a high-activity level in more countries (cf 100).
- Command Level EW has an undetermined number of different products in the foreign markets (cf 100).
- Command Level EW's major activity is categorized as service (cf 100).
- Command Level EW has a specialized customer-oriented service technology (cf 100).
- Command Level EW has a medium routine technology (cf 100).
- Command Level EW's technology is highly divisible (cf 100).
- Command Level EW's technology dominance is strong (cf 100).
- Command Level EW has either planned or already has an advanced information system (cf 100).
- Command Level EW's environment is complex (cf 100).
- The uncertainty of Command Level EW's environment is high (cf 100).
- The equivocality of the organization's environment is high (cf 100).
- Command Level EW's environment is extremely hostile (cf 100).
- Top management prefers to make policy and general resource allocation decisions (cf 100).
- Top management primarily prefers to make both long-term and short-time decisions (cf 100).
- Top management has a preference for very detailed information when making decisions (cf 100).

- Top management has a preference for some proactive actions and some reactive actions (cf 100).
- Top management is risk averse (cf 100).
- Top management has a preference for high control (cf 100).
- Command Level EW operates in an industry with a high capital requirement (cf 100).
- Command Level EW has a medium product innovation (cf 100).
- Command Level EW has a medium process innovation (cf 100).
- Command Level EW has a high concern for quality (cf 100).
- Command Level EW's price level is undetermined relative to its competitors (cf 100).
- The level of trust is medium (cf 100).
- The level of conflict is medium (cf 100).
- The employee morale is medium (cf 100).
- Rewards are given in a not known fashion (cf 100).
- The resistance to change is high (cf 100).
- The leader credibility is medium (cf 100).
- The level of scapegoating is high (cf 100).

THE SIZE

The size of the organization - large, medium, or small - is based upon the number of employees, adjusted for their level of education or technical skills.

Based on the answers you provided, it is most likely that your organization's size is large (cf 100).

More than 75 % of the people employed by Command Level EW have a high level of education. Adjustments are made to this effect. The adjusted number of employees is greater than 2,000 and Command Level EW is categorized as large.

THE CLIMATE

The organizational climate effect is the summary measure of people and behavior.

Based on the answers you provided, it is most likely that the organizational climate is a internal process climate (cf 79).

The internal process climate is a formalized and structured place to work. Procedures govern what people do. The leaders pride themselves on being good coordinators and organizers. Maintaining a smooth running organization is important. The long-term concerns are stability, predictability, and efficiency. Formal rules and policies hold the organization together.

Employees with a medium to low morale is frequently one element of an internal process climate. High resistance to change is normally present in a internal process climate. An organization with a high level of scapegoating may have an internal process climate.

THE MANAGEMENT STYLE

The level of management's microinvolvement in decision making is the summary measure of management style. Leaders have a low preference for microinvolvement; managers have a high preference for microinvolvement.

Based on the answers you provided, it is most likely that your management profile has a high preference for microinvolvement (cf 82).

Since the management has a preference for being very involved in gathering and using detailed information when making decisions, a high preference for microinvolvement characterization is appropriate. Management is risk averse. This is one of the characteristics of a manager with a high preference for microinvolvement. Management has a preference for using control to coordinate activities, which leads toward a high preference for microinvolvement.

THE STRATEGY

The organization's strategy is categorized as one of either prospector, analyzer with innovation, analyzer without innovation, defender, or reactor. These categories follow Miles and Snow's typology. Based on your answers, the organization has been assigned to a strategy category. This is a statement of the current strategy; it is not an analysis of what is the best or preferred strategy for the organization.

Based on the answers you provided, it is most likely that your organization's strategy is an analyzer with innovation strategy (cf 81).

An organization with an analyzer with innovation strategy is an organization that combines the strategy of the defender and the prospector. It moves into the production of a new product or enters a new market after viability has been shown. But in contrast to an analyzer without innovation, it has innovations that run concurrently with the regular production. It has a dual technology core.
For a medium routine technology, Command Level EW has some flexibility. It is consistent with an analyzer with innovation strategy. With a concern for high quality an analyzer with innovation strategy is a likely strategy for Command Level EW.

THE CURRENT ORGANIZATIONAL CHARACTERISTICS

Based on your answers, the organization's complexity, formalization, and centralization have been calculated. This is the current organization. Later in this report, there will be recommendations for the organization.

The current organizational complexity is high (cf 100).

The current horizontal differentiation is high (cf 100).

The current vertical differentiation is medium (cf 100).

The current spatial differentiation is high (cf 100).

The current centralization is medium (cf 100).

The current formalization is high (cf 100).

The current organization has been categorized with respect to formalization, centralization, and complexity. The categorization is based on the input you gave and does not take missing information into account.

SITUATION MISFITS

A situation misfit is an unbalanced situation among the contingency factors of management style, size, environment, technology, climate, and strategy.

The following misfits are present: (cf 100).

Command Level EW is a large organization with a complex and dynamic environment. This may not fit with the managements preference for a high level of microinvolvement! With a complex and dynamic environment, there are a very large number of changing situations to which to adjust. Management cannot access all the situations, analyze what needs to be done and oversee the implementation. There is simply too much to do; there is too much information to deal with. A high level of microinvolvement will usually lead to an information overload at the top and a delay in action when it is most needed. Despite a tendency for management to become even more involved in details, the situation requires less microinvolvement and alternative approaches, such as more decentralization.

Command Level EW has an internal process climate. This may cause problems in a high or moderately high equivocal environment! An internal process climate focuses more on the inside of the organization than on the outside. In an equivocal environment which is likely to require change and adaptation, the internal process climate may not either see the shift, understand the need for change and does not have an organization which supports adaptation to such needed change. There is high resistance to change. An equivocal environment requires an external orientation which is found in the rational goal and development climates.
Command Level EW has an internal process climate. This is a mismatch with analyzer with innovation strategy! An internal process climate is internally oriented with a focus on control. Innovation is difficult to achieve with this orientation. More flexibility and a more external orientation are desirable for innovation. An internal process climate supports better an analyzer without innovation and defender strategy.

ORGANIZATIONAL CONSULTANT RECOMMENDATIONS

Based on your answers about the organization, its situation, and the conclusions with the greatest certainty factor from the analyses above Organizational Consultant has derived recommendations for the organization's configuration, complexity, formalization, and centralization. There are also recommendations for coordination and control, the appropriate media richness for communications, and incentives. More detailed recommendations for possible changes in the current organization are also provided.

ORGANIZATIONAL CONFIGURATIONS

The most likely configuration that best fits the situation has been estimated to be a divisional configuration (cf 85).

It is certainly not: a professional bureaucracy (cf -1).

It is certainly not: a machine bureaucracy (cf -100).

A divisional organization is an organization with self-contained unit grouping into relatively autonomous units coordinated by a headquarters, (product, customer, or geographical grouping).
When the organization is large, the configuration can be a divisional configuration. Because the organization has many products, the configuration should be divisional. The divisionalization of Command Level EW may be based on products or product groups. The divisionalization of Command Level EW may be based on markets. The divisional configuration may be a multi-domestic structure.

A professional bureaucracy is a less likely configuration when top management has a high preference for microinvolvement.

When the organization is confronted with hostility, it cannot be a machine bureaucracy. A machine bureaucracy cannot act appropriately when unexpected events occur.

ORGANIZATIONAL CHARACTERISTICS

The recommended degree of organizational complexity is low (cf 78).

Not much is known about the environment since both the environmental uncertainty and the environmental equivocality of Command Level EW are high. In this situation, the organizational complexity should be low. This allows the organization to adapt quickly. When the environmental hostility of Command Level EW is high, organizational complexity should be low. Top management of Command Level EW has a preference for a high level of microinvolvement, which leads to lower organizational complexity.

The recommended degree of horizontal differentiation is low (cf 78).

The recommended degree of vertical differentiation is low (cf 89).

The recommended degree of formalization is low (cf 68).

It, too, could be: high (cf 59).

Since the set of variables in the environment that will be important is not known and since it is not possible to predict what will happen, no efficient rules and procedures can be developed, which implies that Command Level EW's formalization should be low. When environmental hostility is high formalization should be low.

There should be high formalization between the organizational units but less formalization within the units due to the high professionalization. When the organization uses an advanced information system, formalization should be high. Command Level EW has a high capital requirement, which leads to high formalization. Large organizations should have high formalization. High formalization is consistent with top management's preference for a high level of microinvolvement. An internal process climate in the organization requires a high level of formalization.

The recommended degree of centralization is high (cf 83).

There is evidence against it should be: low (cf -4).

When there is a high capital requirement and the product innovation is medium, as is the case for Command Level EW, centralization should be rather high to obtain efficiency. When the environment is extremely hostile, top management must take prompt action

and centralization must be high. High centralization is required if top management has a preference for a high level of microinvolvement. Because Command Level EW has an advanced information system, centralization can be greater than it could otherwise. An internal process climate in the organization requires a medium to high level of centralization.

Command Level EW's span of control should be moderate (cf 62).

Since Command Level EW has some technology routineness, it should have a moderate span of control.

Command Level EW should use media with high media richness (cf 70).

The information media that Command Level EW uses should provide a large amount of information (cf 70).

Incentives should be based on results (cf 70).

Command Level EW should use meetings as means for coordination and control (cf 85).

It should also use planning (cf 75).

It should also use rules (cf 75).

When the environment of Command Level EW has high equivocality, high uncertainty, and high complexity, coordination and control should be obtained through integrators and group meetings. The richness of the media should be high with a large amount of information. Incentives must be results based. Coordination within each division is very important. Coordination between (among) divisions is usually relegated to top management, which is also concerned about strategic direction and allocation of funds between (among) the divisions. Technology efficiencies can be obtained by sharing technology, information and new developments across divisions. Liaison managers and technology committees are possible coordination mechanisms. Conferences among technical professionals can be very effective.

The recommended structure for Command Level EW is a divisional structure. This structure requires a top management, which will pay attention to strategic issues and problems. The top management's preference for a high microinvolvement does not fit

with the divisional structure. It will likely turn out to be a corrupted divisional structure (Williamson, 1975).

ORGANIZATIONAL MISFITS

Organizational misfits compares the recommended organization with the current organization.

The following organizational misfits are present: (cf 100).

Current and prescribed configuration do not match.
Current and prescribed complexity do not match.
Current and prescribed centralization do not match.
Current and prescribed formalization do not match.

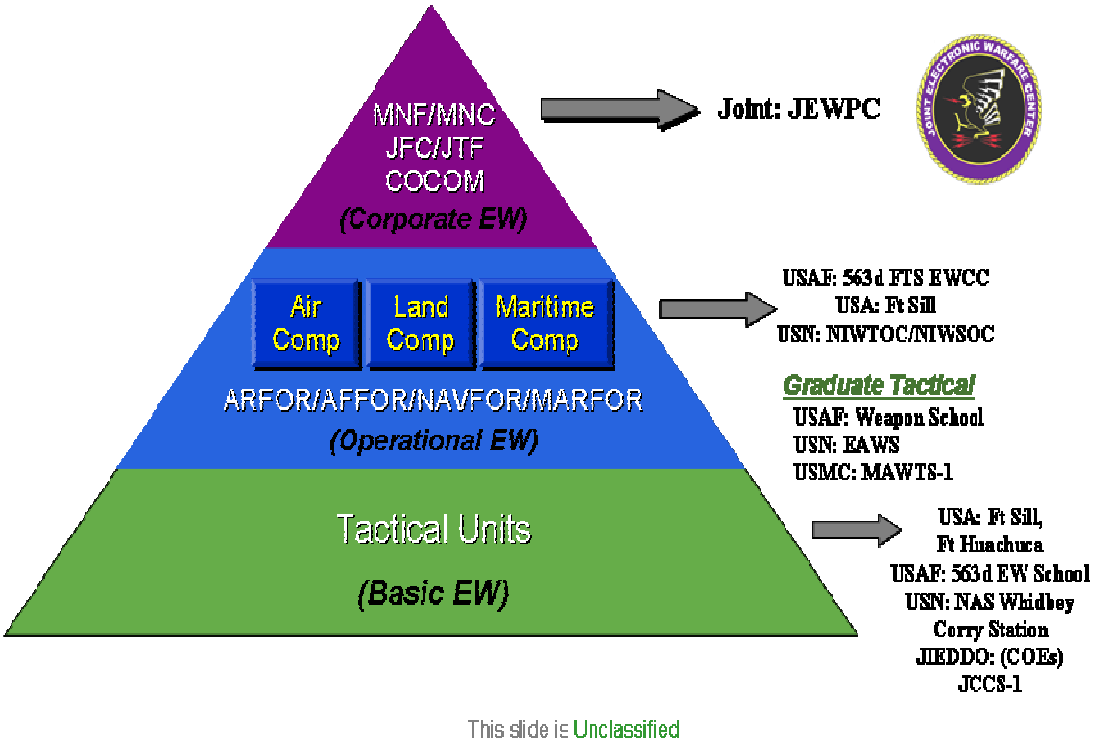
MORE DETAILED RECOMMENDATIONS

There are a number of more detailed recommendations (cf 100).

You may consider decreasing the number of positions for which job descriptions are available.
You may consider supervising the employees less closely.
You may consider allowing employees more latitude from standards.
You may consider fewer written job descriptions.
Managerial employees may be asked to pay less attention to written instructions and procedures.
You may give supervisors and middle managers fewer rules and procedures.
You may consider having fewer rules and procedures put in writing.

END

APPENDIX E. BERG-STOTTS EW EDUCATIONAL CONCEPT "THE BS PYRAMID"



(From: Berg, 2007)

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